

Merrimack River

Tilden St.  
CSO Diversion  
Structure

Perkins St.

Hall St.

Cabot St.

Aiken St.

Northern Canal

Father Morissette Blvd.

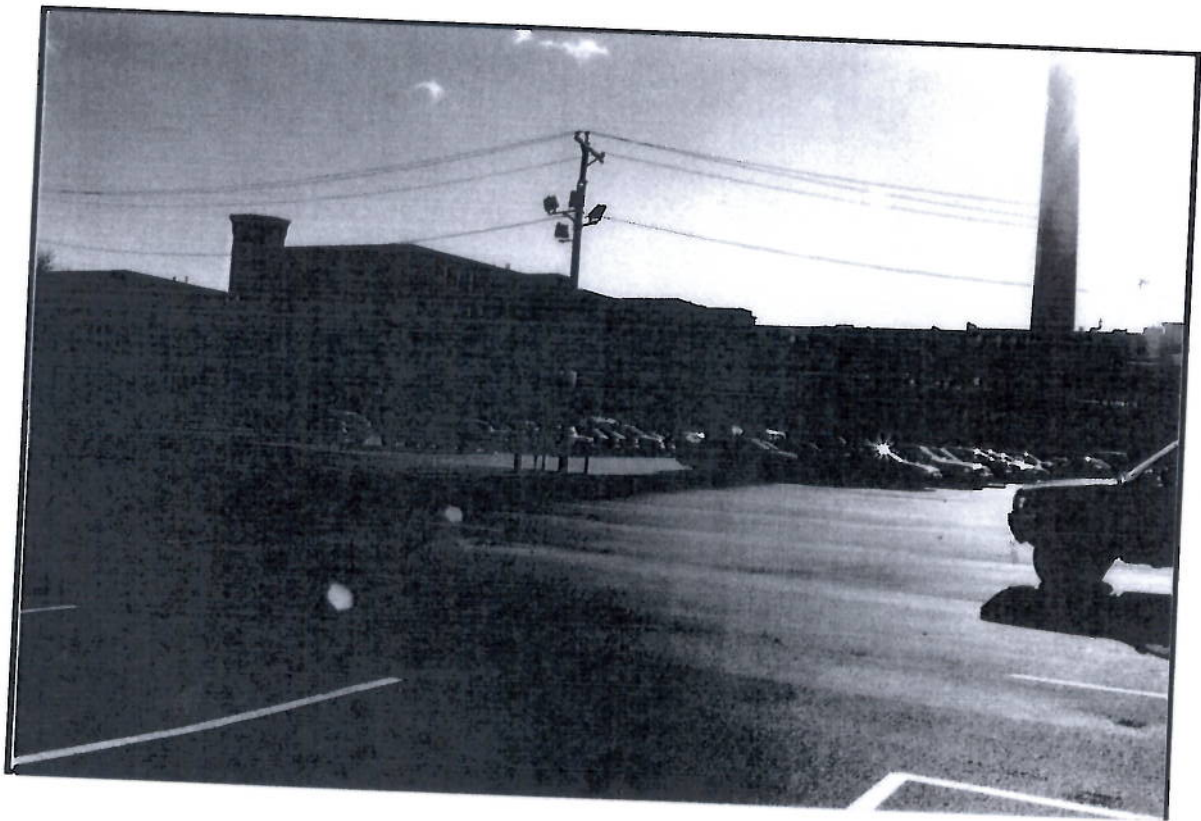
Suffolk St.

Western Canal

**CDM** Camp Dresser & McKee Inc.

Site 14  
Cabot St. / Hall St.





**SITE NO. 14**  
**Tilden Street CSO Location**  
**Cabot Street and Hall Street**





**Site No 15A-Tilden Street CSO**  
**North End of Post Office Square Adjacent to Pump Station**

Location

The site is located on the south bank of the Merrimack River at the north end of Tilden Street and Post Office Square. The site is bounded to the north by the Western Canal, the Merrimack River to the east, and the River Place Towers to the south, and the Tsongas Arena and parking lot to the west. The site is located at the Tilden Street overflow.

Ownership

The site consists of two parcels of land owned by the City of Lowell. [Map 157, parcel 174.1 and Map 158, parcel 205.3]

Area

According to the City assessor's map, the site has a land area of 2.38 acres.

Elevation

Based on City of Lowell topographic mapping the site elevation ranges from 18 to 24 feet. The average site elevation is approximately 21 feet. (Elevations presented herein are based on the City of Lowell Base Datum, to convert to NGVD add 55.20).

Site Access and Traffic

The site is accessible from Tilden Street through the Tsongas Arena parking lot entrance and River Place Street. Both roads are moderately to heavily traveled roads by postal workers, visitors to the arena, and River Place Tower residents. Both roads can accommodate construction traffic.

Current Land Use

The site is a passive park area with benches and walking paths directly north and south of the Tilden Street overflow.

Site Zoning

The site is zoned IA Warehousing, Storage & Light Manufacturing and B3 General Business District. According to the zoning regulations, utilities and public service uses are permitted in these districts but are subject to such requirements specified in Section 31.32, Appendix A-Zoning; Article II-Use Regulations of the Lowell Zoning Code.

Surrounding Land Use/Zoning

The site and all adjacent land areas comprise an IA Industrial District and B3 Business District. The land area to the south portion of the site is zoned B2-A Intermediate Business District. The site is located directly behind the Tsongas Arena and northeast of the River Place Towers. The Merrimack River abuts the site to the east. At the time of the site visit there was evidence of construction work along Tilden Street which separates the two areas that comprise Site 15A.

Environment

Wetlands were not observed on the site, however, the site abuts the Merrimack River to the west and is within the 100-foot Buffer Zone to Inland Bank and may be within the 25-foot Riverfront Area.



No noticeable noise or odors were detected on-site or from adjacent areas during the time of the site visit.

The soils on the site consist of 260-Urban Land.

According to the Lowell Flood Insurance Rate Maps, the eastern portion of the site is located within the 100-year flood zone. The flood elevation for that area is 14.8 feet.

There are no Estimated Habitats or Priority Habitats of rare species within this site as indicated by the Lowell Quadrangle in the Natural Heritage Atlas 2000-2001. However, the site is adjacent to the Merrimack River which is listed as an Estimated Habitat (WH2) and a Priority Habitat (PH1) located east of the site.

#### Historic Features

A brief review of the State Register of Historic Places and the Inventory of Historic and Archaeological Assets of the Commonwealth of the Massachusetts located at the Massachusetts Historical Commission indicates there are no known historical structures on the site. However, the CSO site may be located within archaeological site # 48. The site appears to fall within the City Hall District or the Lock and Canal District.







**Site No 15B-Tilden Street CSO**  
**Off Tilden Street, adjacent to Tsongas Arena**

Location

The site is located west of the Merrimack River and is located south of the Tsongas Arena off Tilden Street. The site is bounded to the north by Tilden Street and the Tsongas Arena, to the south by the River Place Towers, Hall Street and the rotary to the west and the Post Office maintenance building to the east. The site is located approximately 350 feet west of the Tilden Street overflow.

Ownership

The site consists of one parcel of land owned by the City of Lowell. [Map 158 , parcel 44] According to the City of Lowell Engineering Office, the City is currently leasing the site to the U.S Postal Service for vehicle repair work.

Area

According to the City assessor's map, the site has a land area of 1.06 acres.

Elevation

Based on City of Lowell topographic mapping the site elevation ranges from 27 to 30 feet. The average site elevation is approximately 28.5 feet. (Elevations presented herein are based on the City of Lowell Base Datum, to convert to NGVD add 55.20).

Site Access and Traffic

The site is accessible from Tilden Street and Hall Street through the parking lot entrances. Both roads are moderately traveled roads used by postal workers, River Place Tower residents and visitors to the Arena. Both roads can accommodate construction traffic.

Current Land Use

The site is a parking lot site which appears to be used by Post Office workers.

Site Zoning

The site is zoned B2-A Intermediate Business District. According to the zoning regulations, utilities and public service uses are permitted in this district but are subject to such requirements specified in Section 31.32, Appendix A-Zoning; Article II-Use Regulations of the Lowell Zoning Code.

Surrounding Land Use/Zoning

The adjacent land area to the northwest is an IA Industrial District and to the east, the land area is a B3 Business District. The site is located south of the Tsongas Arena and is east of the Post Office maintenance building.

Environment

Wetlands were not observed on the site. The site is not located within the 100-foot Buffer Zone to Inland Bank or the 25-foot Riverfront Area.

No noticeable noise or odors were detected on-site or from adjacent areas during the time of the site visit.



The soils on the site consist of 260-Urban Land.

According to the Lowell Flood Insurance Rate Maps, the site is not located within the 100-year flood zone.

There are no Estimated Habitats or Priority Habitats of rare species within this site as indicated by the Lowell Quadrangle in the Natural Heritage Atlas 2000-2001.

#### Historic Features

A brief review of the State Register of Historic Places and the Inventory of Historic and Archaeological Assets of the Commonwealth of the Massachusetts located at the Massachusetts Historical Commission indicates there are no known historical structures on the site. However, the CSO site maybe located within archaeological site # 48. The site appears to fall within the City Hall District or the Lock and Canal District.





**Site No 15C-Tilden Street CSO  
Off Hall Street, Across from Tsongas Arena**

**Location**

The site is located west of the Merrimack River and is located immediately west of the Tsongas Arena off of Hall Street. The site is bounded to the north by the Western Canal, to the south by the Post Office and rotary, and Father Morissette Blvd. to the west. The site is located approximately 650 feet west of the Tilden Street overflow.

**Ownership**

The site consists of one parcel of land owned by Commonwealth of Massachusetts, Environmental Management. [Map 137, parcel 257]

**Area**

According to the City assessor's map, the site has a land area of 3.82 acres.

**Elevation**

Based on City of Lowell topographic mapping the site elevation ranges from 27 to 30 feet. The average site elevation is approximately 28.5 feet. (Elevations presented herein are based on the City of Lowell Base Datum, to convert to NGVD add 55.20).

**Site Access and Traffic**

The site is accessible from Father Morissette Blvd. through the parking lot entrances. The road is a main road and is a moderately to heavily traveled road. The road appears to be able to accommodate construction traffic. Minor traffic delays might occur during high volume traffic periods of the day.

**Current Land Use**

The land areas that comprise Site 18C are currently new paved parking lots which appear to provide parking for the Tsongas Arena.

**Site Zoning**

The site is zoned IA Warehousing, Storage & Light Manufacturing. According to the zoning regulations, utilities and public service uses are permitted in this district but are subject to such requirements specified in Section 31.32, Appendix A-Zoning; Article II-Use Regulations of the Lowell Zoning Code.

**Surrounding Land Use/Zoning**

The site is an IA Industrial District. The adjacent land area to the north is a B3 Business District, to the west and southwest the land area is a B2-A Business District. The land area south west of the site across Father Morissette Blvd. is a M3 Residence District. The site is located west of the Tsongas Arena and is located off of Hall Street. The area north of the site is comprised of the Western Canal, a mills complex and a vacant building. West of the site is a vacant building and Father Morissette Blvd.. The Post Office and the rotary are located south of the site.

**Environment**

Wetlands were not observed on the site. The site is within the 100-foot Buffer Zone to Inland Bank and the 25-foot Riverfront Area.

No noticeable noise or odors were detected on-site or from adjacent areas during the time of the site visit.

The soils on the site consist of 260-Urban Land.

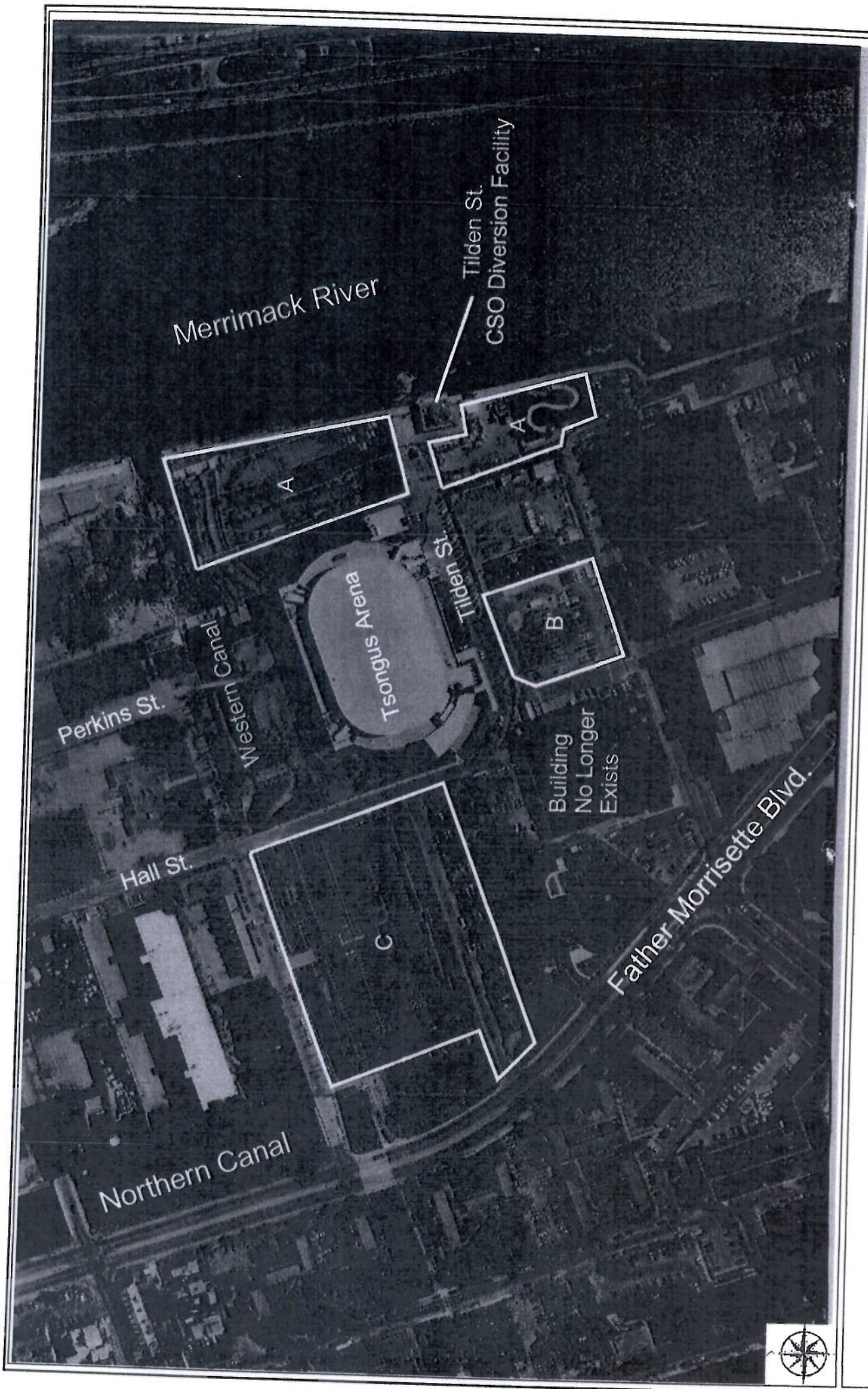
According to the Lowell Flood Insurance Rate Maps, the site is not located within the 100-year flood zone.

There are no Estimated Habitats or Priority Habitats of rare species within this site as indicated by the Lowell Quadrangle in the Natural Heritage Atlas 2000-2001.

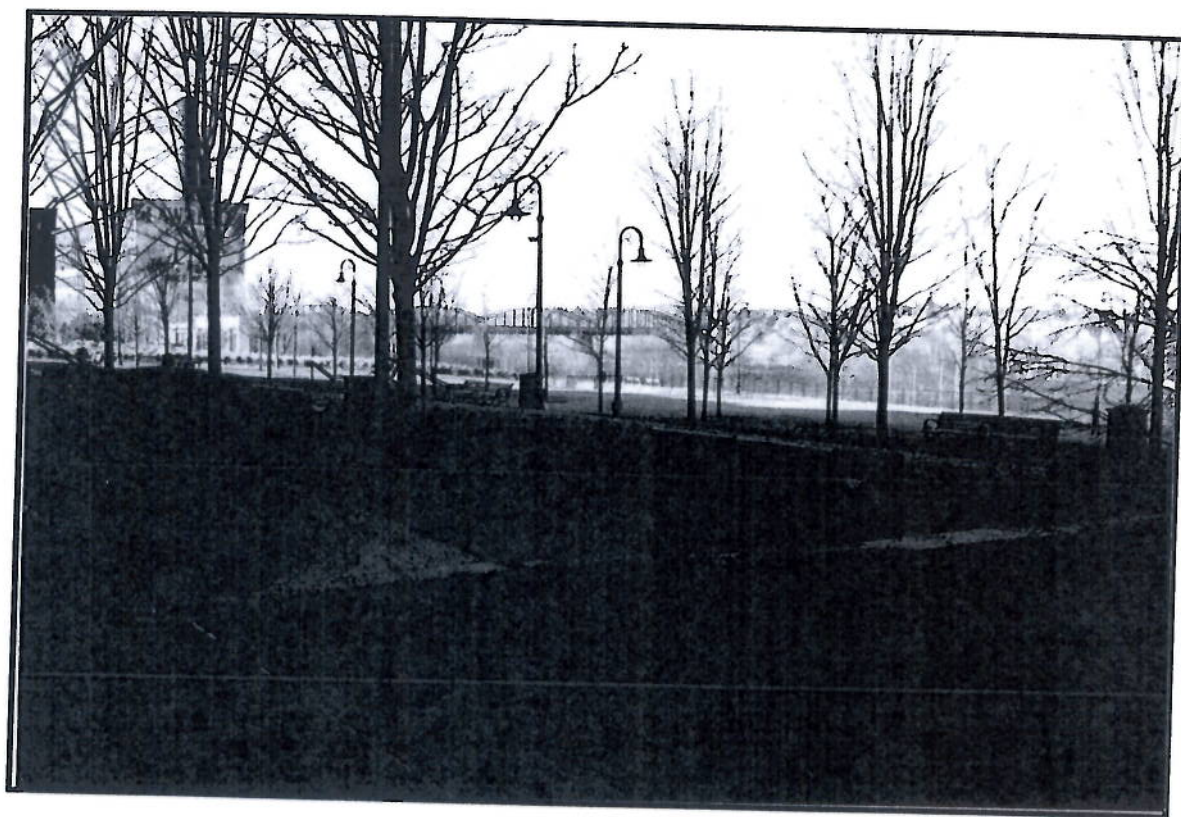
#### Historic Features

A brief review of the State Register of Historic Places and the Inventory of Historic and Archaeological Assets of the Commonwealth of the Massachusetts located at the Massachusetts Historical Commission indicates there are no known historical structures on the site. However, the CSO site may be located within archaeological site # 48. The site appears to fall within the City Hall District or the Lock and Canal District.







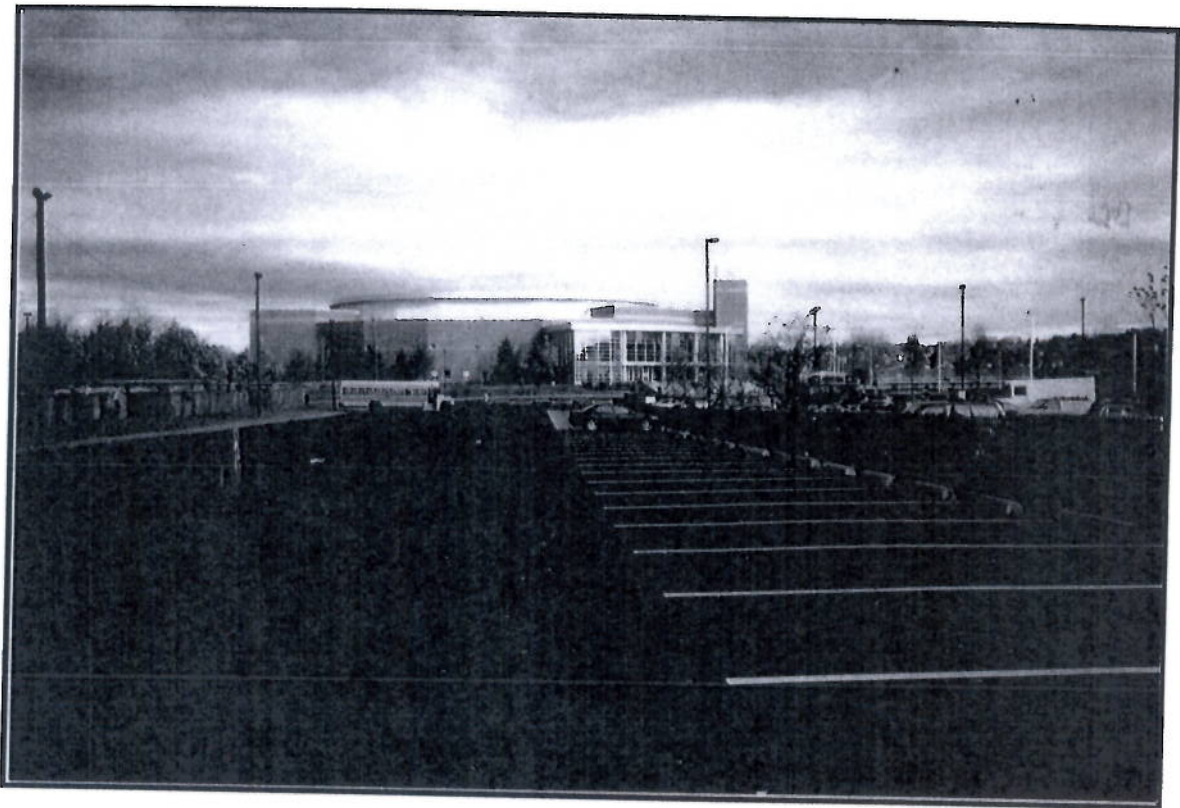


**SITE NO. 15A**  
**Tilden Street CSO Location**  
**North End of Post Office Square**





**SITE NO. 15B**  
**Tilden Street CSO Location**  
**Tilden Street, across from Tsongas Arena**



**SITE NO. 15C**  
**Tilden Street CSO Location**  
**Hall Street, across from Tsongas Arena**



**Site No. 16-Warren Street CSO  
Broadway Street and Pawtucket Street**

**Location**

The site is located south of the Merrimack River in the mid-western portion of Lowell. The site is bounded by Pawtucket Street to the northwest and west, Broadway Street to the north, UMass Lowell South Campus Building to the east, and Boston & Maine Railroad tracks to the south. The Walker Street CSO overflow is located approximately 2,000 feet north east of the site.

**Ownership**

The site consists of one parcel owned by the Commonwealth of Massachusetts. [Map 86 parcel 910].

**Area**

According to the City assessor's map, the site has a land area of 7.58 acres.

**Elevation**

Based on City of Lowell topographic mapping, the site elevation ranges from 30 to 35 feet. The average site elevation is approximately 32.5 feet. (Elevations presented herein are based on the City of Lowell Base Datum, to convert to NGVD add 55.20).

**Site Access and Traffic**

The site is accessible from Broadway Street through the parking lot entrance. Broadway Street appears to be able to accommodate construction traffic. Minor traffic delays might occur during high volume traffic periods of the day.

**Current Land Use**

The site is a paved parking lot for the UMass Lowell South Campus area. At the time of the site visit, the parking lot was heavily occupied by vehicles.

**Site Zoning**

The site is zoned 1A Warehousing, Storage & Light Manufacturing Industrial District. According to the zoning regulations, utilities and public service uses are permitted in this district as a special exception only if the board of appeals determines and grants a special permit therefor as provided in Section 31-15, Appendix A-Zoning, of the Lowell Zoning Code.

**Surrounding Land Use/Zoning**

The site and adjacent land southeast of the site are all part of the same 1A Warehousing, Storage & Light Manufacturing Industrial District. The land area north of the site is zoned M3 Multi-Family Residence District. The land area south of the site is zoned B1 Local Business District. The parking lot is bordered by the Vulkor Industrial buildings south of the site, immediately adjacent to the B & M Railroad tracks. A baseball field and the Lowell Humane Society are located across Broadway Street north of the site. There are no residential properties in the immediate vicinity of the site.

**Environment**

Wetlands were not observed on the site or adjacent to the site. The site is not within the 100-foot Buffer Zone or the 25-foot Riverfront Area.

No noticeable noise or odors were detected on-site or from adjacent areas during the time of the site visit.

The soils on the site consist of 260-Urban Land.

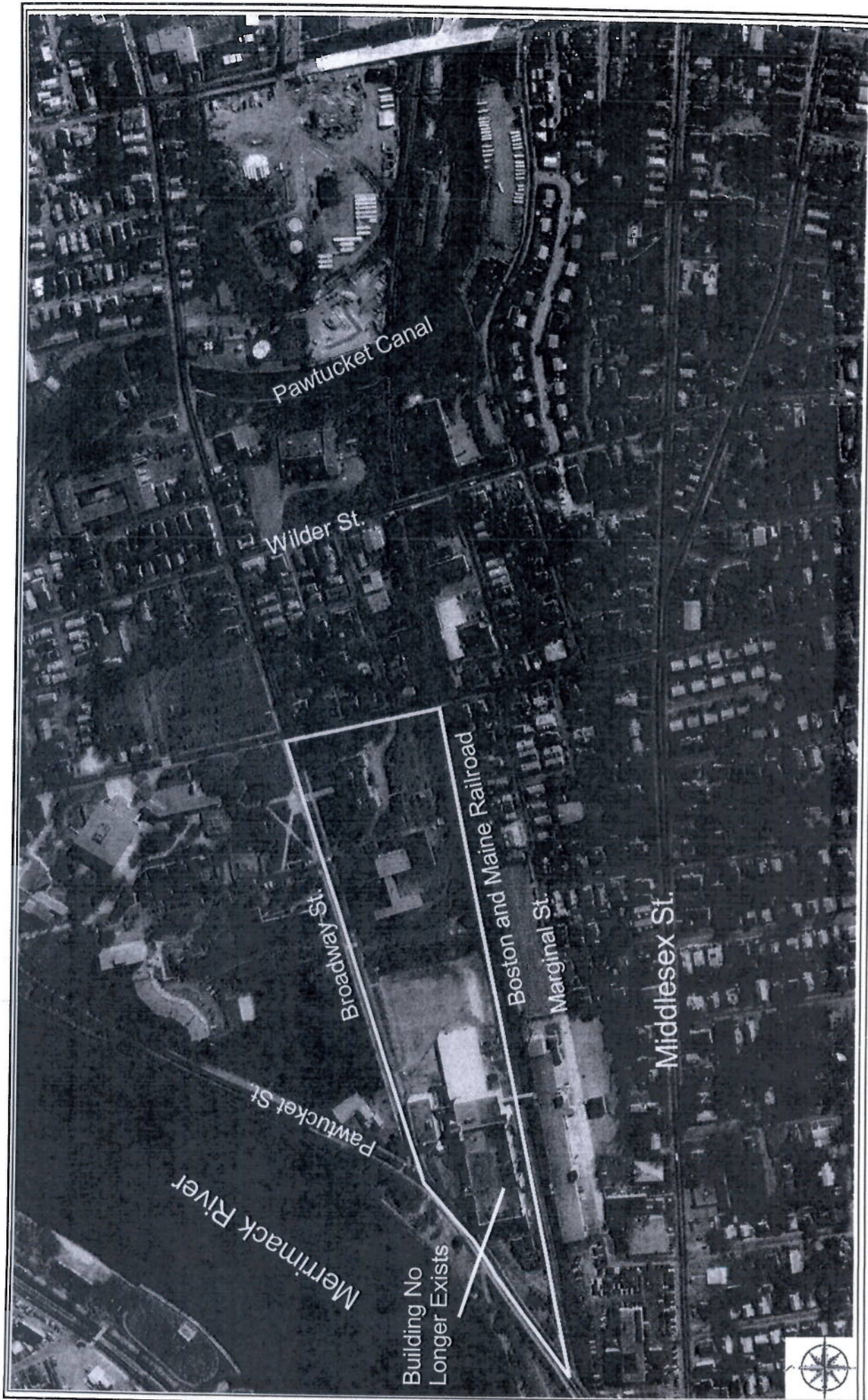
According to the Lowell Flood Insurance Rate Maps, a portion of the site is located within the 100-year flood zone. The flood elevation for the site is 44.80.

The CSO site is located south of the Merrimack River which is listed as an Estimated Habitat (WH2) and a Priority Habitat (PH1) as indicated by the Lowell Quad in the Natural Heritage Atlas 2000-2001.

#### Historic Features

A brief review of the State Register of Historic Places and the Inventory of Historic and Archaeological Assets of the Commonwealth of the Massachusetts located at the Massachusetts Historical Commission indicates there are no known historical structures on site or within the vicinity. The site does not appear to fall within a historic district.



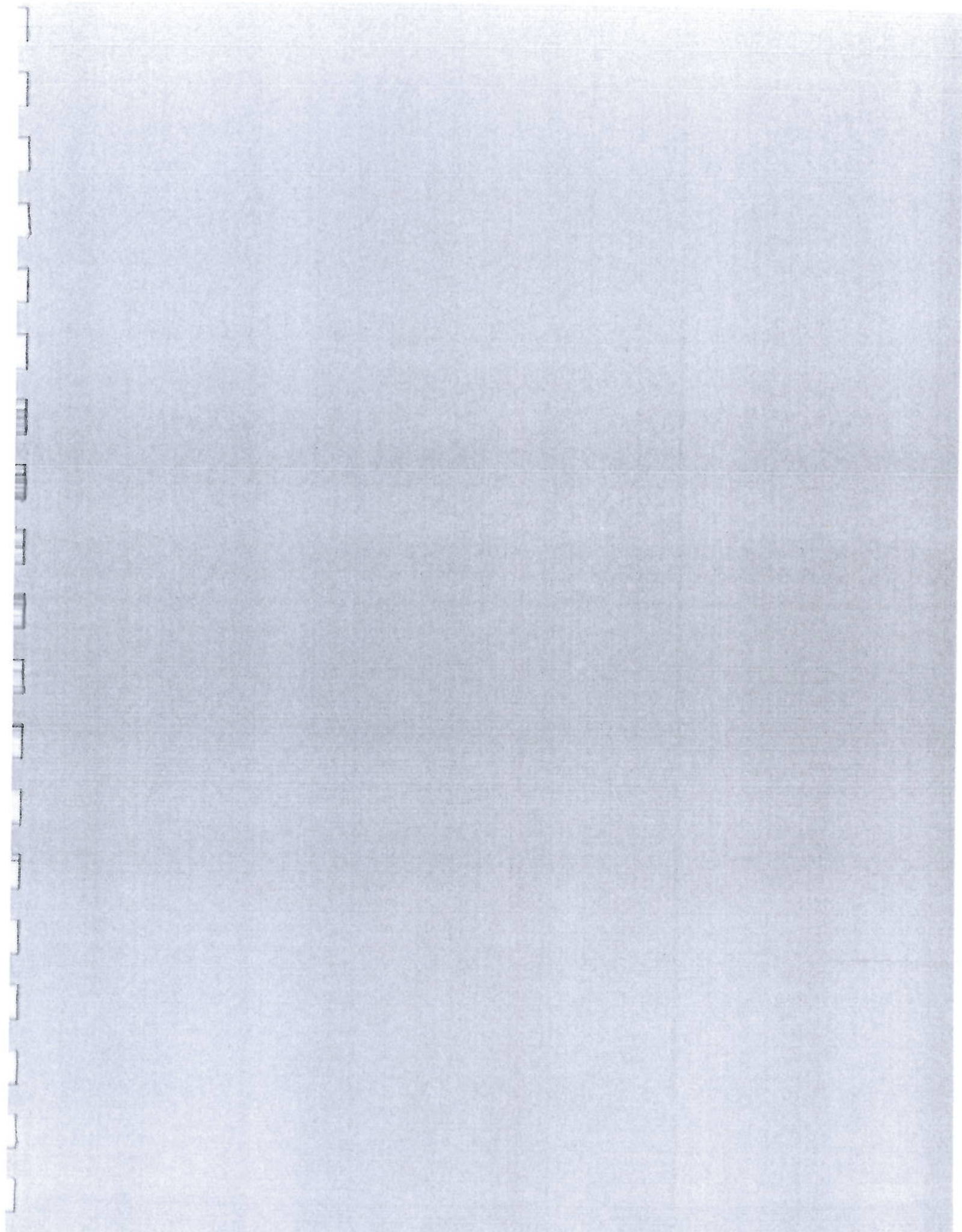






**SITE NO. 16**  
**Warren Street CSO Location**  
**Broadway Street and Pawtucket Street**





**Site No. 17-Warren Street CSO  
Saunders Street and Middlesex Street**

Location

The site is located south of the Pawtucket Canal in the center portion of Lowell. The site is bounded by Saunders Street to the west, Middlesex Street to the south, Aspara Jewelry commercial property to the east, and Meng's Auto Repair, Diamond Yellow Taxi Cab, and the Pawtucket Canal to the north. The Warren Street CSO overflow is located approximately 4,000 feet east of the site.

Ownership

The site consists of one parcel owned by the Commonwealth of Massachusetts. [Map 120, parcel 803 and Map 121 parcel 747].

Area

According to the City assessor's map, the site has a land area of 2.86 acres.

Elevation

Based on City of Lowell topographic mapping, the site elevation ranges from 33 to 36 feet. The average site elevation is approximately 34.5 feet. (Elevations presented herein are based on the City of Lowell Base Datum, to convert to NGVD add 55.20).

Site Access and Traffic

The site is accessible from Saunders Street and Middlesex Street. Middlesex Street is a main road and can experience heavy traffic volume during high volume traffic period of the day. However, both roads appear to be able to accommodate construction equipment and traffic. Minor traffic delays might occur during high volume traffic periods of the day.

Current Land Use

The site is an open parcel comprised of a skate board park, basketball courts, tennis courts, volleyball courts, a playground area, and a small baseball field.

Site Zoning

The site is zoned 1A Warehousing, Storage & Light Manufacturing Industrial District. According to the zoning regulations, utilities and public service uses are permitted in this district as a special exception only if the board of appeals determines and grants a special permit therefor as provided in Section 31-15, Appendix A-Zoning, of the Lowell Zoning Code.

Surrounding Land Use/Zoning

The site and adjacent land east of the site are all part of the same 1A Warehousing, Storage & Light Manufacturing Industrial District. The land area west and south of the site is zoned B1 Local Business District. The multi-use park is bordered by Sanders Street and B & J Auto Sales west of the site, Middlesex Street and small businesses across the street including Lowell Discount Carpet, Lowell Auto Repair, a small vacant building, and Pailin Plaza (with a video store, hair design, and insurance agency) to the south, and Aspara Jewelry to the east. Small businesses including Meng's A & B Auto Repair and a parking lot immediately adjacent and the Diamond Yellow Taxi Cab are located north of the site, on the other side of the park fence along Payne Street. The Pawtucket Canal borders Payne Street to the north. There are no residential properties in the immediate vicinity of the site.



### Environment

Wetlands were not observed on the site or adjacent to the site. The site is not located within the 100-foot Buffer Zone or the 25-Foot Riverfront Area

No noticeable noise or odors were detected on-site or from adjacent areas during the time of the site visit.

The soils on the site consist of 260-Urban Land, 261- Merrimac-Urban land Complex, and 55-Udorthents Loamy.

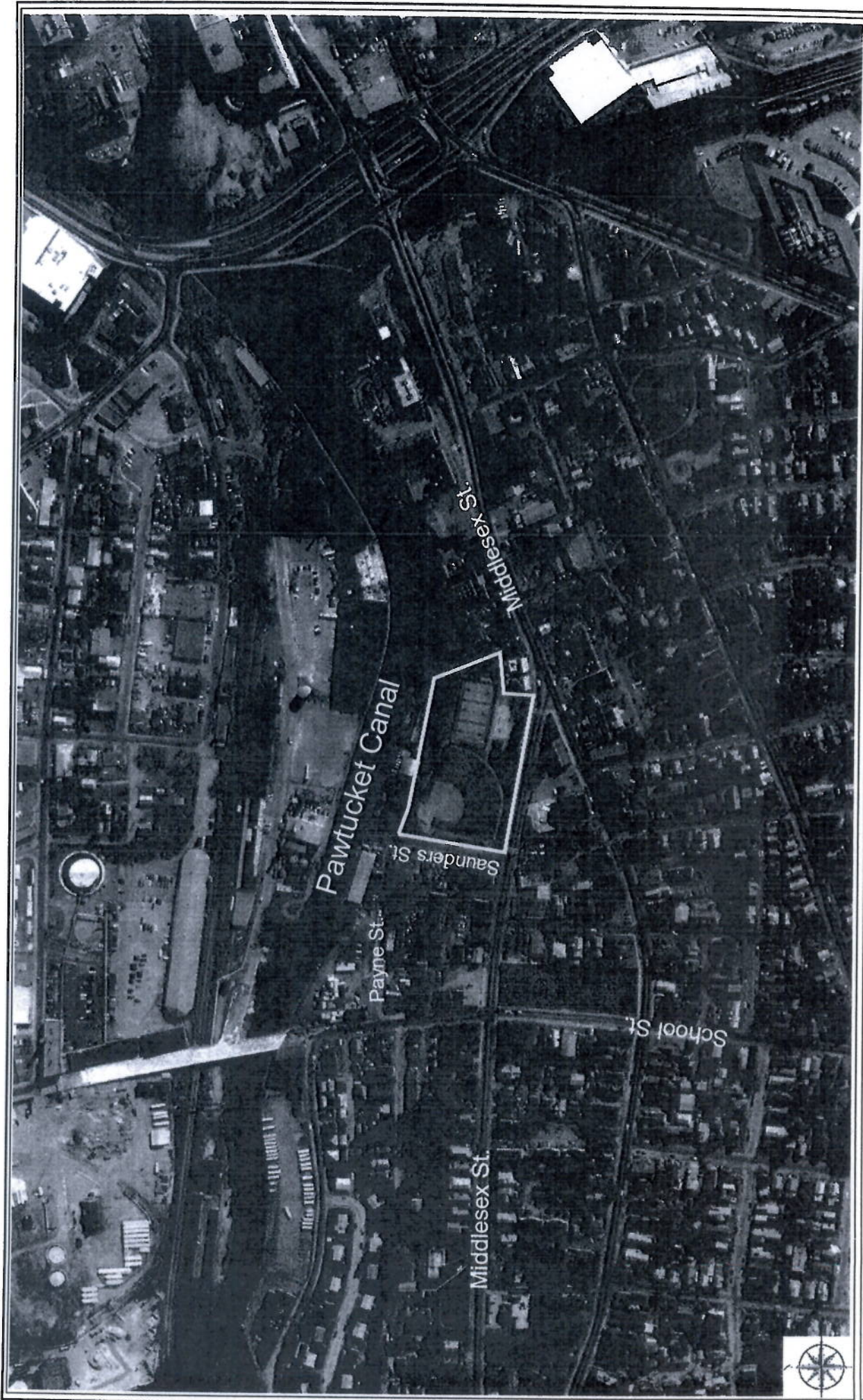
According to the Lowell Flood Insurance Rate Maps, the site is not located within the 100-year flood zone.

The site is located south of the Pawtucket Canal, which is a tributary of the Merrimack River. The Merrimack River is listed as an Estimated Habitat (WH2) and a Priority Habitat (PH1) as indicated by the Lowell Quad in the Natural Heritage Atlas 2000-2001.

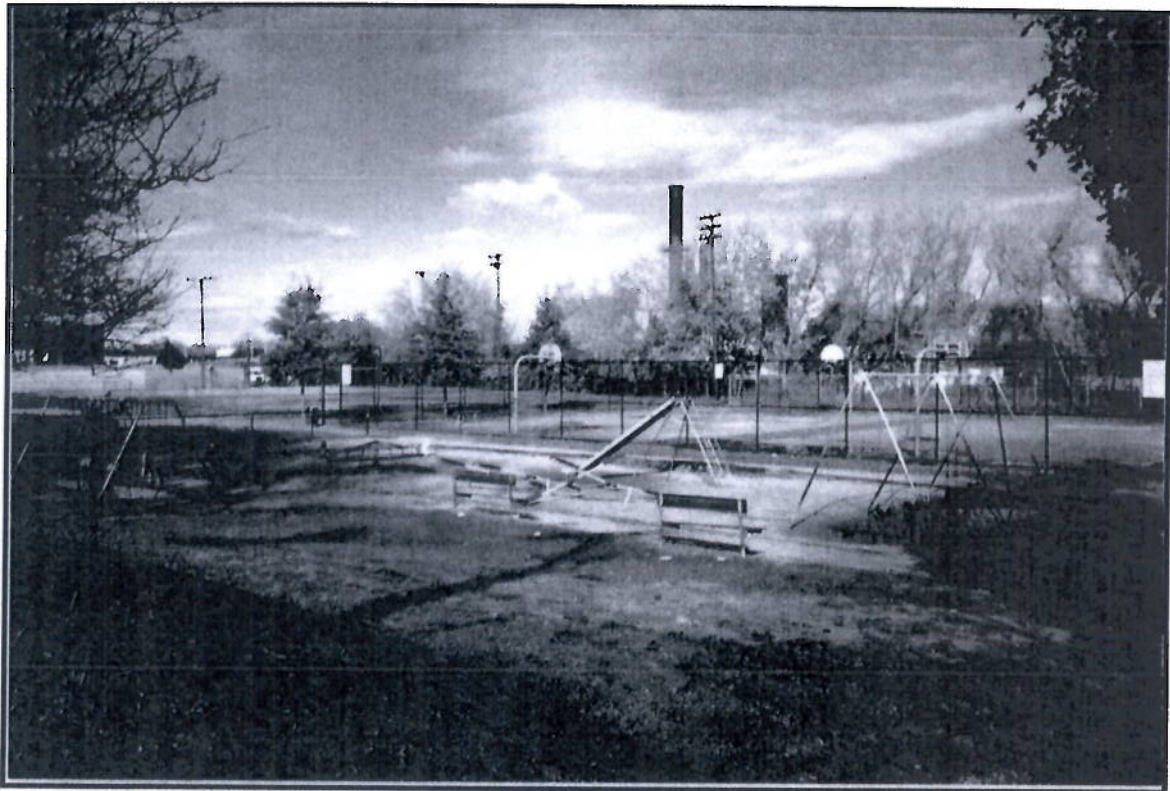
### Historic Features

A brief review of the State Register of Historic Places and the Inventory of Historic and Archaeological Assets of the Commonwealth of the Massachusetts located at the Massachusetts Historical Commission indicates there are no known historical structures on site or within the vicinity. The site does not appear to fall within a historic district.









**SITE NO. 17**  
**Warren Street CSO Location**  
**Saunders Street and Middlesex Street**



Site No 18-Warren Street CSO  
Thordike Street and Jackson Street

#### Location

The site along the Merrimack Canal in the north is the center of Lowell. The site is bounded by the Merrimack Canal to the north, by Union Street to the east, Thordike Street to the west, and the Low Overpass and King Street to the south. The site is located approximately 3,000 feet southwest from the Warren Street CSO overflow.

#### Ownership

The site consists of one parcel owned by TRS Appraisal Mill #5 Parking, Map 140, parcel 2, also under Map 161 parcel 3511.

#### Area

According to the City assessor's map, the site has a land area of 1.7 acres.

#### Elevation

Based on City of Lowell topographic mapping, the site elevation ranges from 42.8 to 44.6 feet. The average site elevation is approximately 43.7 feet. Elevations presented herein are based on the City of Lowell Base Datum, as compared to NGVD and 1920.

#### Site Access and Traffic

The site is accessible from King Street and Jackson Street. Both roads are in good condition and can accommodate construction traffic without traffic delays.

#### Current Land Use

The site is a vacant paved lot. At the time of the initial site visit it was undeveloped. The site was 111' x 111'.

#### Site Zoning

The site is zoned a M5 General Business District and a Warehouse, Storage and Light Manufacturing District. According to the zoning regulations, industrial and public service uses are permitted to develop on the site as long as they comply with the requirements specified in Section 11.22, Appendix A Zoning Article 11- Use Regulations of the Lowell Zoning Code.

#### Surrounding Land Use/Zoning

The site and adjacent land surrounding the site are all part of the same M5 General Business and M Warehouse, Storage and Light Manufacturing. The area adjacent to the east is also an open lot. Land to the south of the site consists of commercial business and an abandoned building. The land area to the west consists of residential properties.

#### Regulations

No federal regulations are located on the site, however, the site is within the Merrimack Canal to the north and a portion of the site is within the 25-foot Riverfront Area and the 10-foot Buffer Zone to Boat.

No significant noise or other uses located on site or from adjacent areas during the visit of the site visit.





**SITE NO. 18**  
**Warren Street CSO Location**  
**Thorndike Street and Jackson Street**





**Site No. 19-Warren Street CSO**  
**Chelmsford Street and Hutchins Street**

Location

The site is located west of the River Meadow Brook in the south region of Lowell. The site is located at the east side of Chelmsford Street (Route 110). The site is bounded by Route 110 to the north and west, Lincoln Street to the east and the Abraham Lincoln Elementary School to the south. The site is located approximately 6,000 feet southwest from the Warren Street CSO overflow.

Ownership

The site consists of one parcel owned by the City of Lowell, Lincoln School. [Map 143, parcel 294]

Area

According to the City assessor's map, the site has a land area of .38 acres.

Elevation

Based on City of Lowell topographic mapping, the site elevation ranges from 60.4 to 60.8 feet. The average site elevation is approximately 60.6 feet. (Elevations presented herein are based on the City of Lowell Base Datum, to convert to NGVD add 55.20).

Site Access and Traffic

The site is accessible from Route 110. The road can experience moderate to heavy traffic volume during high volume traffic period of the day and can accommodate construction equipment. Traffic delays may result at times from high traffic volume.

Current Land Use

The site is an open parcel comprised of a softball field located adjacent to the Abraham Lincoln Elementary School.

Site Zoning

The site is zoned B1 Local Business District and SM2 Suburban Multi-Family Residence District. According to the zoning regulations, utilities and public service uses are permitted in these districts as a special exception only if the board of appeals determines and grants a special permit therefor as provided in Section 31-15, Appendix A-Zoning, of the Lowell Zoning Code.

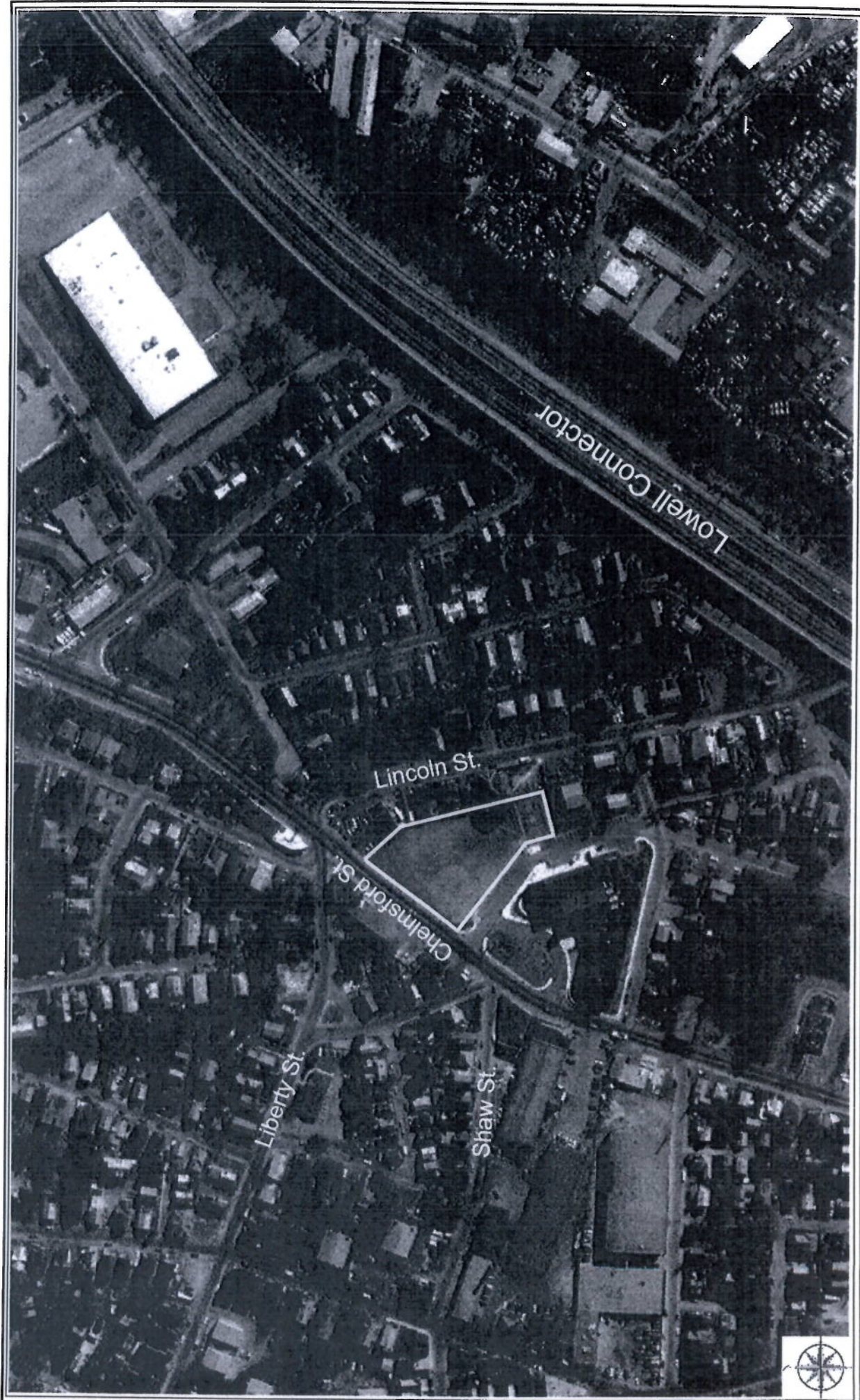
Surrounding Land Use/Zoning

The surrounding land area south and east of the site is zoned SM2 Suburban Multi-Family. The remainder of the surrounding land area is zoned as B1 Local business. Residential houses occupy Lincoln Street east of the site. A gas station, storage building and parking lot are located on Route 110 across the street from the site to the north and west. The Lincoln Elementary School is located south of the site.

Environment

Wetlands were not observed on the site or adjacent to the site. The site is not located within the 100-foot Buffer Zone or the 25-foot Riverfront Area.









**SITE NO. 19**  
**Warren Street CSO Location**  
**Chelmsford Street and Hutchins Street**





**Site No. 20 -Warren Street CSO  
Rear Tanner Street and Maple Street**

Location

The site is located north of Maple Street and south of the River Meadow Brook in the south portion of Lowell. The site is bounded by abandoned railroad tracks to the north, west and east, and by wetlands to the south. The site is located approximately 5,000 feet southwest of the Warren Street CSO overflow.

Ownership

The site consists of one parcel and is owned by Boston & Maine Railroad. [Map 165, parcel 121]

Area

According to the City assessor's map, the site has a land area of 3.86 acres.

Elevation

Based on City of Lowell topographic mapping, the site elevation ranges from 44 to 56 feet. The average site elevation is approximately 50 feet. (Elevations presented herein are based on the City of Lowell Base Datum, to convert to NGVD add 55.20).

Site Access and Traffic

The site is accessible from a dirt road off Maple Street. The road can accommodate construction traffic without traffic delay. However, a bridge located on Route 3A has low clearance which may prevent large construction vehicles from travelling through certain areas.

Current Land Use

The site is a vacant wooded lot that abuts a pond and wetlands to the south. The majority of the site is not currently in use, however, a small portion is used for storing railroad ties and other miscellaneous debris.

Site Zoning

The site is zoned IA Warehouse, Storage, and Light Manufacturing Industrial District. According to the zoning regulations, utilities and public service uses are permitted in this district but are subject to such requirements specified in Section 31.32, Appendix A-Zoning; Article II-Use Regulations of the Lowell Zoning Code.

Surrounding Land Use/Zoning

South and west of the site is zoned TF Two-Family Dwellings and B1 Local Business. North and east is zoned IA Warehousing, Storage and Light Manufacturing. At the time of the site visit a hazardous waste site was observed west of the site. All other land surrounding the site is currently used for industrial purposes. No parks or residential properties are located near the site.

Environment

Wetlands were not observed on the site, however, the site abuts a pond to the south and the southern portion of the site is located within the 100-foot Buffer Zone of Bordering Vegetated Wetlands along the pond.

A hazardous waste site is located west of the site. The abutting site was fenced in and posted and appeared to be part of an operating plant.

There was noise coming from the adjacent plant at 1:00 P.M, no odors were detected on-site or from adjacent areas during the time of the site visit.

The soils on the site consist of the following: 5-Udorthents, sandy and 261-Urban Land, wet substratum

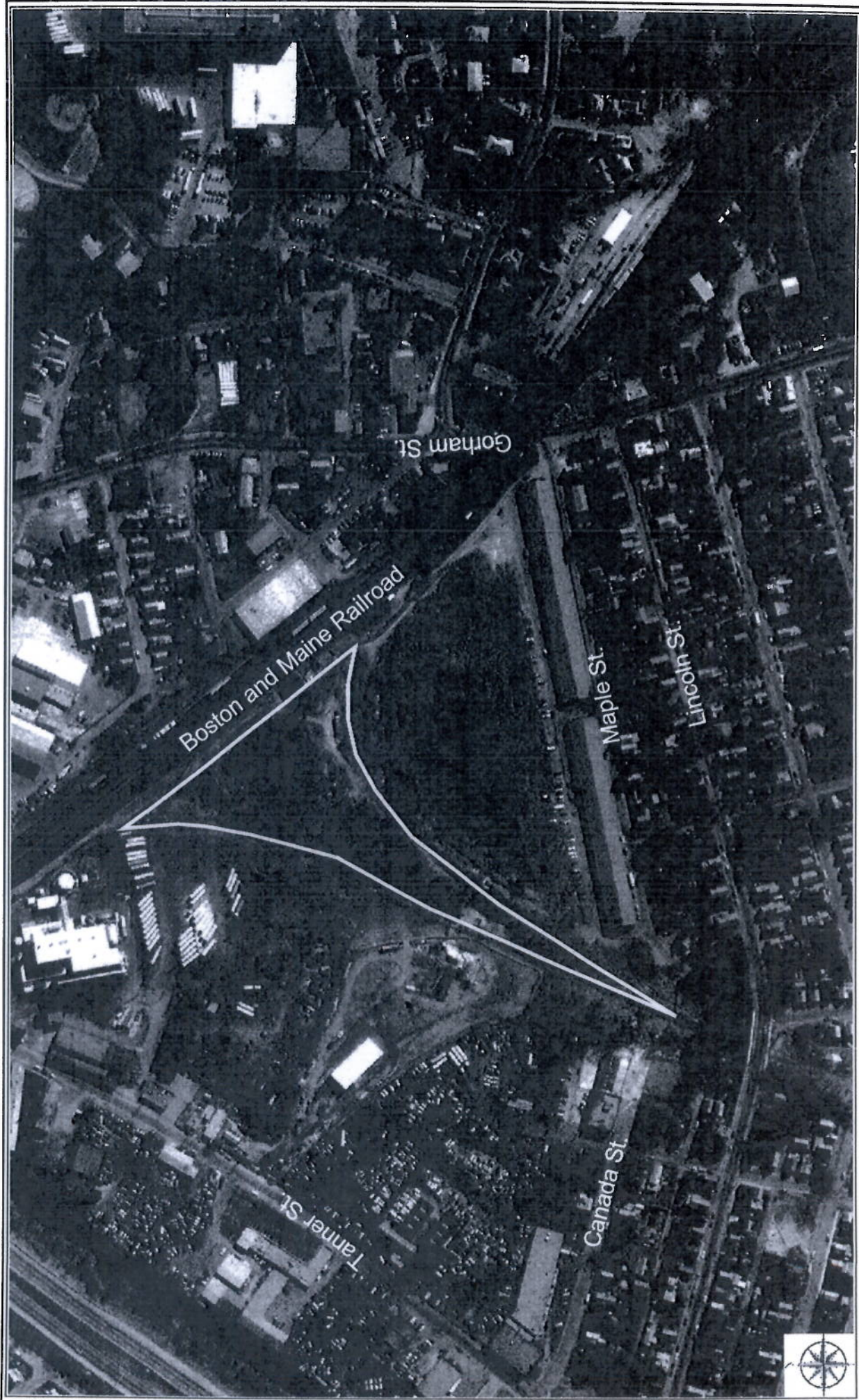
According to the Lowell Flood Insurance Rate Maps, the site is not located within the 100-year flood zone.

There are no Estimated Habitats or Priority Habitats of rare species within the site as indicated by the Lowell Quad in the Natural Heritage Atlas 2000-2001.

#### Historic Features

A brief review of the State Register of Historic Places and the Inventory of Historic and Archaeological Assets of the Commonwealth of the Massachusetts located at the Massachusetts Historical Commission indicates there are no known historical structures or archaeological sites within the CSO site. The site does not appear to fall within a historic district.









**SITE NO. 20**  
**Warren Street CSO Location**  
**Rear Tanner Street and Maple Street**





**Site No. 21-Warren Street CSO  
Newhall Street and Chambers Street**

**Location**

The site is located on the north bank of River Meadow Brook in the southeast portion of Lowell. The site is located at the intersection of Newhall Street and Chambers Street. The site is bound by a vacant lot with trees to the west, a building to the east, residential houses to the north, and Meadow Brook to the south. The site is located approximately 4,050 feet south from the Warren Street overflow.

**Ownership**

The site consists of two parcels bisected by Newhall Street owned by the City of Lowell. [Map 183, parcels 84 and 85]

**Area**

According to the City assessor's map, the site has a land area of 0.87 acres.

**Elevation**

Based on City of Lowell topographic mapping, the site elevation ranges from 29 to 35.8 feet. The average site elevation is approximately 32.4 feet. (Elevations presented herein are based on the City of Lowell Base Datum, to convert to NGVD add 55.20).

**Site Access and Traffic**

The site is accessible from Chamber Street and Newhall Street. Both roads appear to be able to accommodate construction traffic. Minor traffic delays might occur during high volume traffic periods of the day.

**Current Land Use**

The site is comprised of two open space parcels (Oliveria Park) bisected by Newhall Street. The park consists of a playground on the west and a baseball field and a parking lot on the east side, and a paved parking lot that abuts the River Meadow Brook to the north.

**Site Zoning**

The site is zoned IA Warehousing, Storage and Light Manufacturing. According to the zoning regulations, utilities and public service uses are permitted in this district but are subject to such requirements specified in Section 31.32, Appendix A-Zoning; Article II-Use Regulations of the Lowell Zoning Code.

**Surrounding Land Use/Zoning**

The surrounding land area except for north of the site, which is zoned both UM2 Urban Multi-Family is zoned IA Warehousing, Storage and Light Manufacturing. Residential properties abut the property to the north on both sides of Newhall Street and Kinsman Street. Two sets of garages abut the site to the west and a building is located east of the site.

**Environment**

Wetlands were not observed on the site, however, the site area abuts River Meadow Brook to the north and is within the 100-Foot Buffer Zone to Inland Bank and may be within the 25-foot Riverfront Area.



No noticeable noise or odors were detected on-site or from adjacent areas during the time of the site visit.

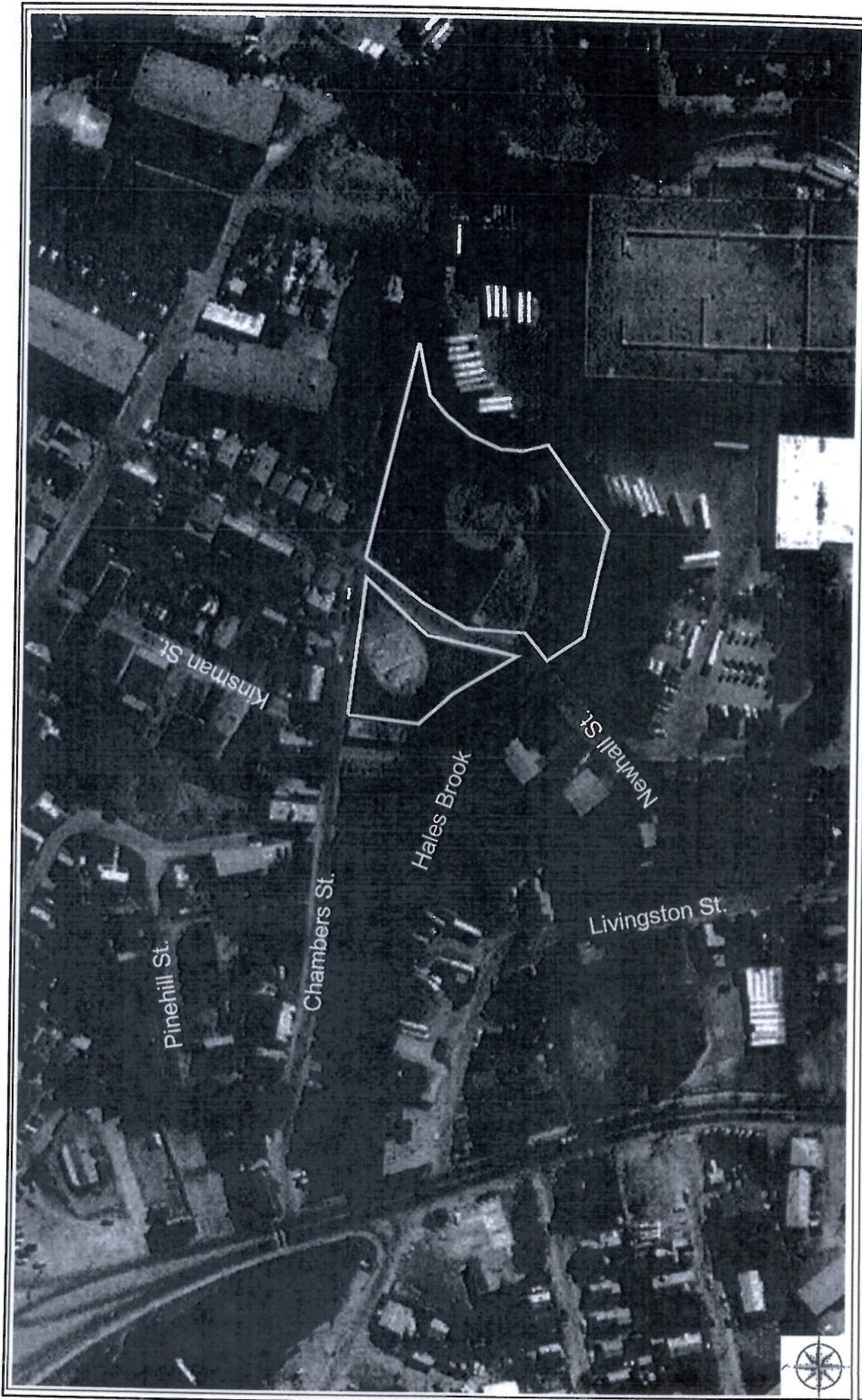
According to the Lowell Flood Insurance Rate Maps, the southeastern portion of the site is within the 100-year flood zone. The flood elevation for the eastern portion of the site is 25.8 feet.

Soils in the area consist of the following: 555-Udorthents, wet substratum and 261-Urban Land, wet substratum.

There are no Estimated Habitats or Priority Habitats of rare species within this site as indicated by the Lowell Quadrangle in the Natural Heritage Atlas 2000-2001.

#### Historic Features

A brief review of the State Register of Historic Places and the Inventory of Historic and Archaeological Assets of the Commonwealth of the Massachusetts located at the Massachusetts Historical Commission indicates there are no known historical structures or archaeological sites within the CSO site. The site does not appear to fall within a historic district.







**SITE NO. 21**  
**Warren Street CSO Location**  
**Newhall Street and Chambers Street**

F

Appendix  
F



## Memorandum

To: *Distribution*

From: *Jim Drake*  
*Joshua MacCulloch*

Date: *June 7, 2000*

Subject: *Lowell CSO Long-Term Control Plan*  
*Procedures for Estimating Alternative treatment/Storage Costs*

Capital and operation & maintenance (O&M) costs estimates for alternative CSO treatment/storage options will be developed based partly on cost curves provided in EPA's *Manual - Combined Sewer Overflow Control*. These cost curves were updated based on the current Engineering News Record (ENR) construction cost index. The EPA updated cost curves were then supplemented with additional cost information provided by the CDM cost estimating group, with cost data from recent CSO construction projects, and from costs provided in other New England CSO long term control plans.

### Available Cost Data

Figures 1 through 6 present curves of cost as a function of either flow rate or volume for primary sedimentation, pumping, screening, disinfection, storage, and swirl concentrators. Each curve contains data from one or more of the following sources:

1. **Updated EPA Cost Curves** - Each figure contains the updated cost curve from the EPA *Manual - Combined Sewer Overflow Control*. The EPA curves were originally prepared in 1993 and include ENR indexes of either 4500 or 4800. Figures 1 through 6 include these curves updated to the May 2001 ENR index of 6288.
2. **CDM Cost Estimates** - In 1997, as part of the Nashua CSO Long term Control Plan, CDM prepared a preliminary design of a 100-mgd treatment facility and a 10 million gallon (MG) storage facility. The treatment facility included a 100-mgd pump station, screening, primary settling, and disinfection. The majority of the facilities were assumed to be below ground at depths of 40 to 50 feet with superstructures for odor control, chemical feed, and electrical. The primary settling costs in this estimate were based on the circular primary tanks in Manchester, NH, and the pump station costs were estimated based on the New Bedford CSO storage/pump back facility.

Since the CDM estimate was based on a 100-mgd treatment facility/10 MG storage facility, the costs had to be scaled either up or down to alternate sized facilities by using the following equations which CDM has developed using a number of wastewater treatment projects.

For facilities that the cost was based on flow rate(in mgd):

$$\text{New Cost} = [\text{New flow (in mgd)}/100 \text{ mgd}]^{0.67} * 100\text{-mgd facility cost (in \$)}$$

For facilities that the cost was based on flow volume (in MG):

$$\text{New Cost} = [\text{New volume (in MG)}/10 \text{ MG}]^{0.67} * 10\text{-MG facility cost (in \$)}$$

3. **Recent Construction and Planning Projects** – Additional cost estimates were obtained from miscellaneous CDM construction projects and planning documents. These included the Lowell CSO Long Term Control Plan, the Narragansett Bay Commission Bucklin Point CSO Report, the New Bedford WWTP construction costs, and construction of the Rouge River storage facilities in Michigan. For each of these projects, costs were updated to present day using a 3 percent per year inflation rate from the year of construction and/or the date of the report. The facilities and reports used are listed below with their design flow rate and their adjusted cost estimate.

<u>Primary Sedimentation</u>	<u>Flow</u>	<u>Adjusted Cost</u>
Lowell 1990 CSO Study	20 mgd	\$1.86 million
	100 mgd	\$11.04 million
NBC Bucklin Point	24-46 mgd	\$4.75 million
	70 mgd	\$5.12 million
New Bedford WWTP	75 mgd	\$11.26 million
<u>Pumping</u>	<u>Flow</u>	<u>Adjusted Cost</u>
Misc. CDM P.S.	10 mgd	\$ 2.95 million
	13 mgd	\$3.28 million
Lowell 1990 CSO Study	3 mgd	\$0.83 million
	10 mgd	\$2.19 million
	100 mgd	\$13.88 million
NBC Bucklin Point	46 mgd	\$3.50 million
	72 mgd	\$4.48 million
	116 mgd	\$6.00 million
New Bedford WWTP	75 mgd	\$5.90 million



<b><u>Screening</u></b>		
Lowell 1990 CSO Study	Flow	Adjusted Cost
	10 mgd	\$1.31 million
	100 mgd	\$2.73 million
NBC Bucklin Point	116 mgd	\$5.03 million
NBC CSO Area C	85 mgd	\$1.53 million
	169 mgd	\$4.04 million
	486 mgd	\$15.84 million
<b><u>Disinfection (Chlorination / Dechlorination)</u></b>		
Lowell 1990 CSO Study	Flow	Adjusted Cost
	10 mgd	\$0.5 million
	100 mgd	\$2.73 million
NBC Bucklin Point	70 mgd	\$1.91 million
New Bedford WWTP	75 mgd	\$4.26 million
<b><u>Storage</u></b>		
NBC CSO Study	Flow	Adjusted Cost
	4.2 mgd	\$9.18 million
	8.2 mgd	\$18.90 million
	17 mgd	\$39.88 million
Rouge River *	1.9 MG	15.73 million
	2.2 MG	15.11 million
	2.7 MG	20.95 million
	2.8 MG	18.00 million
	3.1 MG	20.64 million
	4.0 MG	11.94 million
	5.2 MG	26.96 million
	5.5 MG	29.31 million
	10.0 MG	22.89 million
	22.0 MG	55.22 million

\* Actual Construction costs updated by current ENR index

In general, CDM's updated costs were higher than the updated EPA cost curves. The EPA curves may have been based on treatment/storage facilities constructed at or near the ground surface rather than below grade, self contained structures as was assumed in the

CDM estimate. Also, the EPA curves probably do not contain the level of instrumentation and odor control that would be necessary for treatment/storage facilities constructed today. Finally, it is unclear from the literature whether or not the EPA disinfection curve includes dechlorination facilities. CDM's curve and construction cost estimates do include dechlorination.

### **Adopted Treatment Process Costs**

Treatment process costs for Lowell will be developed based on a selected cost curve for each process. Selection of the appropriate cost curve was completed by reviewing all the above cost data and adopting the curve that most closely resembles anticipated conditions in Lowell. Figures 1 through 6 present all cost data and indicate the adopted curve for each treatment process. The following paragraphs summarize the rationale for selection of the adopted curve.

#### **Figure 1 – Primary Sedimentation Cost Curve**

The CDM curve was adopted for primary sedimentation because it appears to more accurately reflect recent WWTP construction and planning projects. Additionally, the higher CDM curve likely reflects the increased need for odor control and instrumentation that may not be as accurately reflected in the lower EPA curve.

#### **Figure 2 – Pumping Cost Curve**

The EPA curve was adopted for pumping because it appears to more accurately reflect recent pumping station construction and planning projects. The CDM cost curve appears to be too conservative.

#### **Figure 3 – Screening Cost Curve**

The CDM curve was adopted for screening for flow rates less than or equal to 10 mgd and the EPA curve was adopted for flow rates greater than 10 mgd. Since there was limited data available for facilities less than 10 mgd, the more conservative CDM curve was adopted. Above 10 mgd, the EPA curve was more conservative and matched a number of recent construction projects so it was adopted.

#### **Figure 4 – Disinfection Cost Curve**

An average of the CDM cost curve and EPA cost curve was adopted for disinfection. From the data, it appears that the CDM curve was too conservative and the EPA curve was not conservative enough. An average of the two curves appears to best fit the data. This average curve also ensures that the costs of any required dechlorination process equipment are accounted for.



#### Figure 5 – Storage Cost Curve

The CDM curve was adopted for storage volumes less than or equal to 0.4 MG and the EPA curve was adopted for volumes greater than 0.4 MG. Since there was no construction or planning data available for storage facilities less than 0.4 MG the more conservative CDM curve was adopted. For volumes above 0.4 MG, the EPA curve was more conservative and seemed to more closely match the existing data.

#### Figure 6 – Swirl Concentrators

Two times the EPA cost curve was selected for swirl concentrators. There was no CDM cost information available for swirl concentrators with the exception of recent information collected for the Manchester, New Hampshire project. Here it was estimated that swirl concentrator costs may be 1 to 3 times higher than the EPA cost curves due to a wide range of loading rates that are site specific. As a conservative measure, the EPA cost curve was doubled and adopted for this study.

### **Combination of Alternatives**

The Lowell CSO Long Term Control Plan will evaluate 5 alternatives for abatement of CSOs. These options include:

- Screening with disinfection
- Swirl concentrators with disinfection
- Primary treatment (screening, sedimentation, and disinfection)
- Storage (and pump back if necessary)
- Sewer separation (subject of another project memorandum)

To arrive at capital costs for each of these treatment alternatives, the adopted cost curves for each treatment process was added together to obtain a total cost curve for each alternative. An allowance of 10 percent was added to each treatment alternative to account for yard piping that will be necessary when treatment processes are combined. The summation of these curves for each treatment alternative, including 50 percent allowances for engineering and contingencies, is included in Figure 7.

### **Operation and Maintenance (O&M) Costs**

Similar to the capital cost curves, the EPA O&M cost curves were also updated by the current ENR index and adopted for this study. EPA O&M curves were available for screening, disinfection, and sedimentation and the updated curves are presented in Figure 8. No curves were available for storage or swirl concentrators so their O&M costs were

assumed to be that for sedimentation. As can be seen from this figure, the costs for screening are highly dependant on the number of overflows per year.

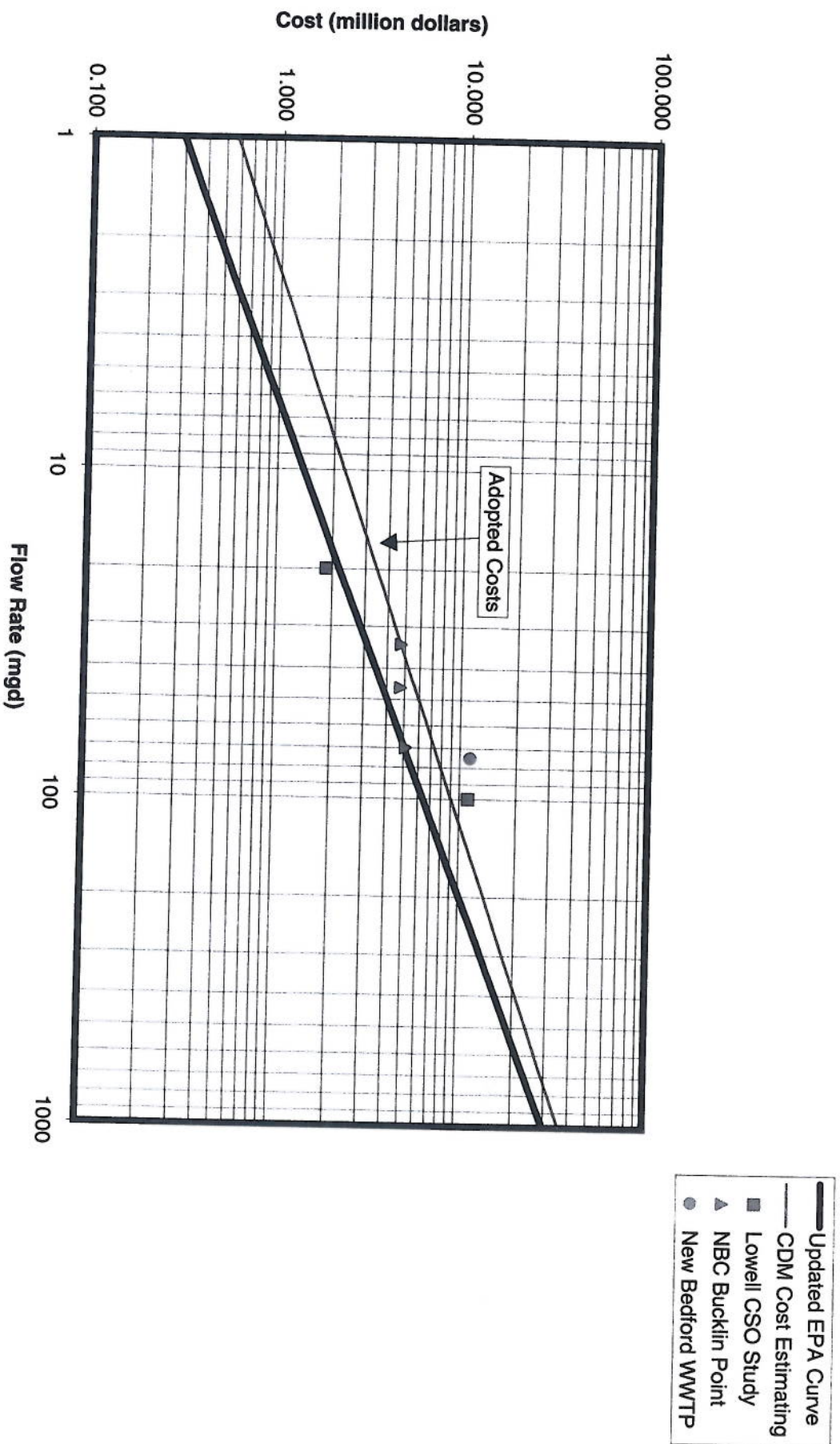
Similar to the capital costs, the O&M costs for each treatment process were added together as appropriate to arrive at total O&M cost for each of the treatment alternatives to be studied in Lowell. Figure 9 includes this summary and represents the total O&M cost for screening with disinfection, swirl concentrators with disinfection, primary treatment (screening, sedimentation, and disinfection), and storage.

### **Summary**

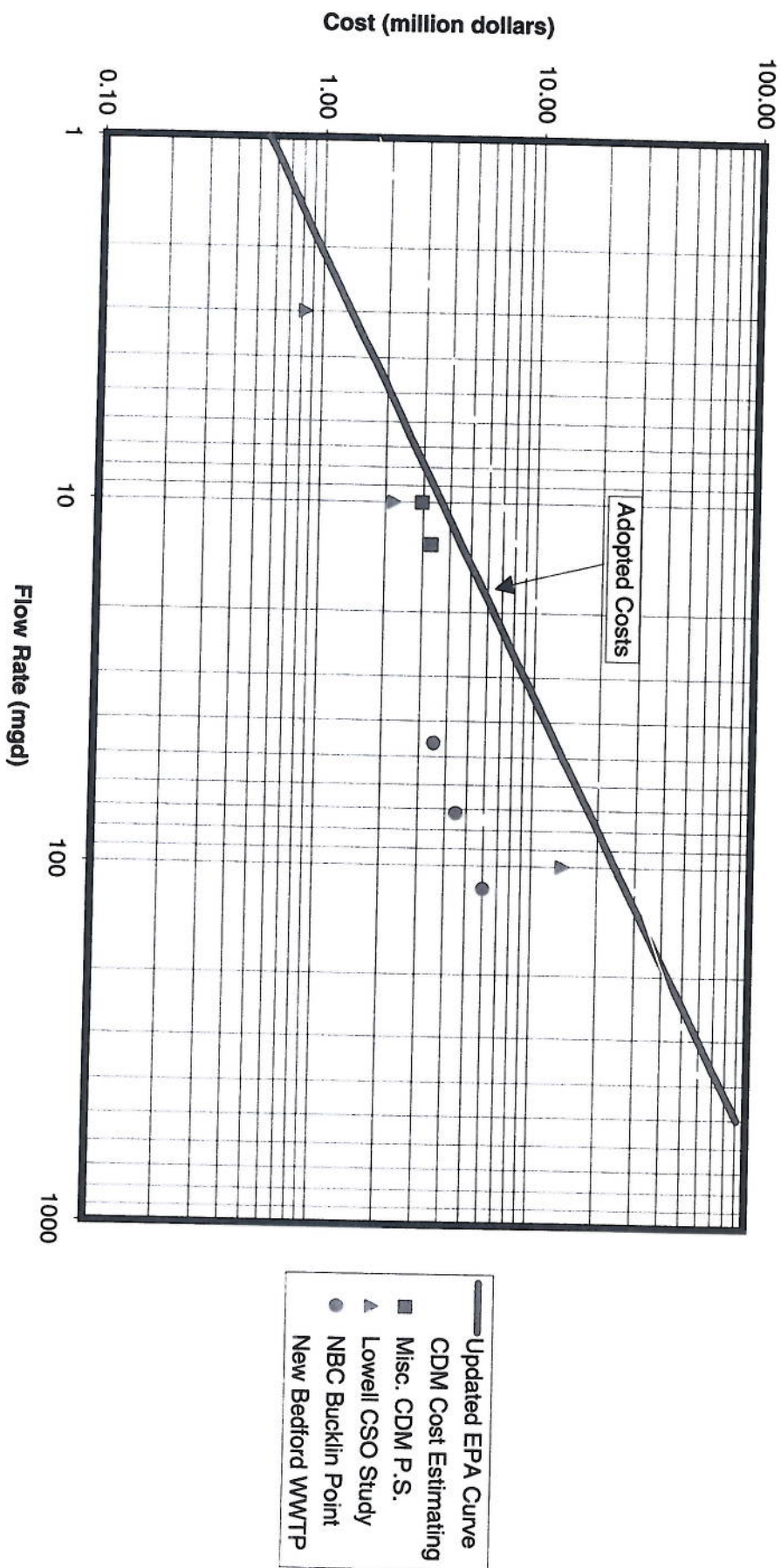
Figure 7 presented the estimated capital cost curve for each treatment alternative to be analyzed for each CSO in Lowell with allowances for engineering and contingencies. Similarly, Figure 9 presented the estimated O&M cost curve for each treatment alternative. The approach for estimating alternative facility costs for the facility plan analyses will be to read the capital and O&M costs off of these curves for the appropriately sized facility necessary to abate a particular CSO.



**Figure 1**  
**Updated Comparison of Primary Sedimentation Costs**

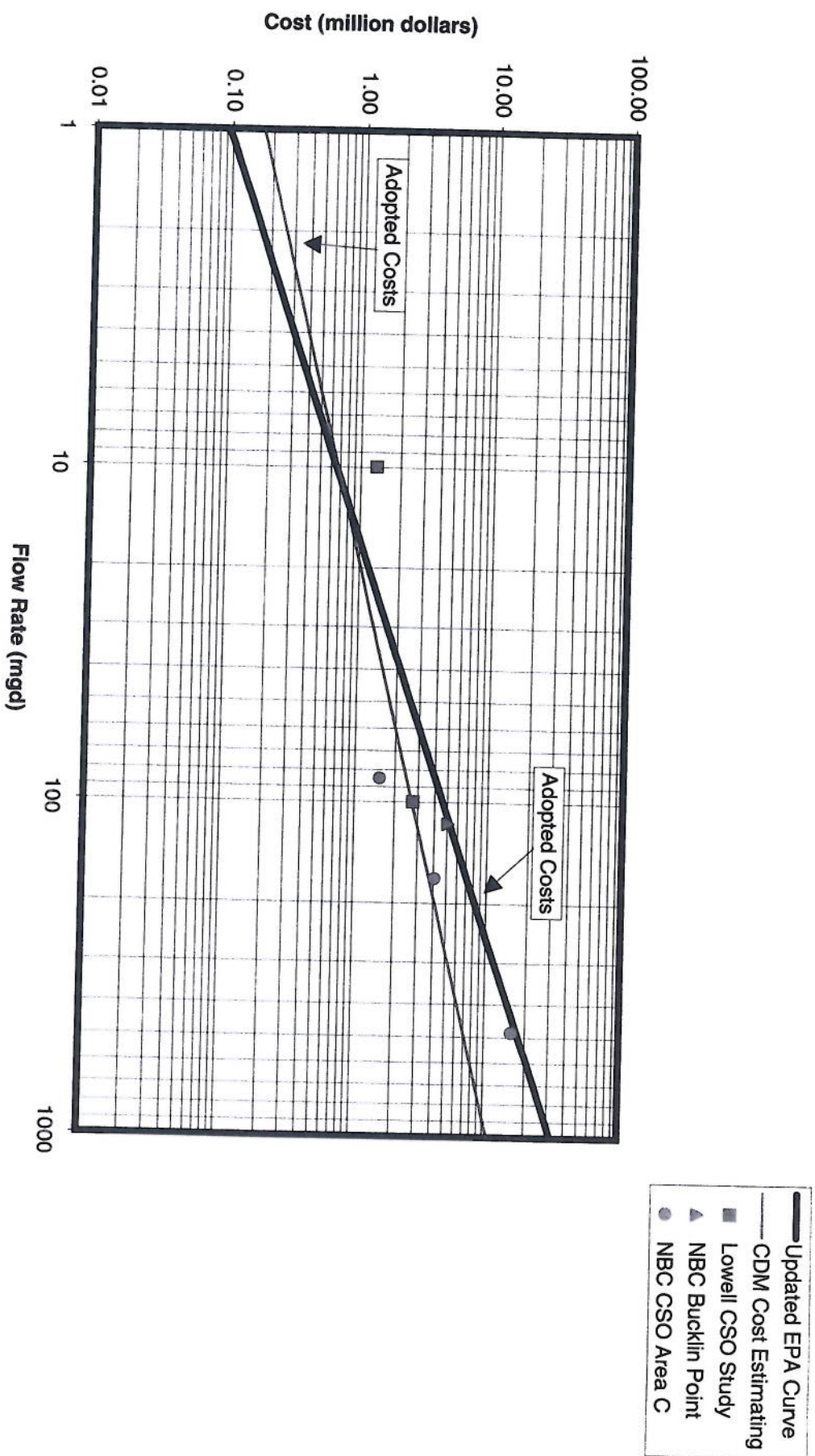


**Figure 2**  
**Comparison of Pumping Costs**

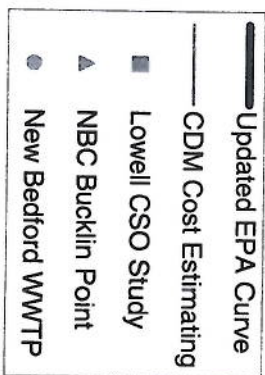
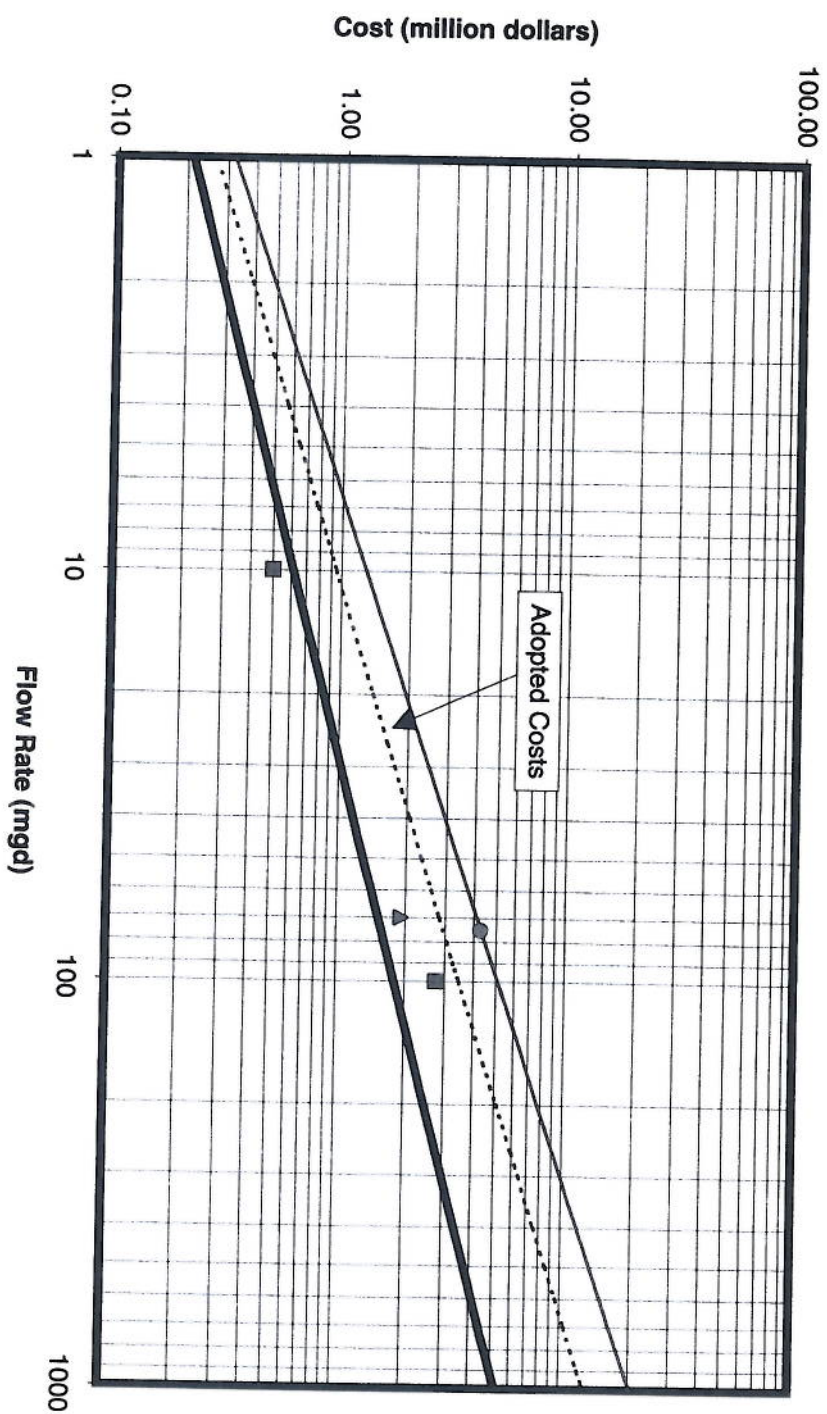




**Figure 3**  
**Comparison of Screening Costs**

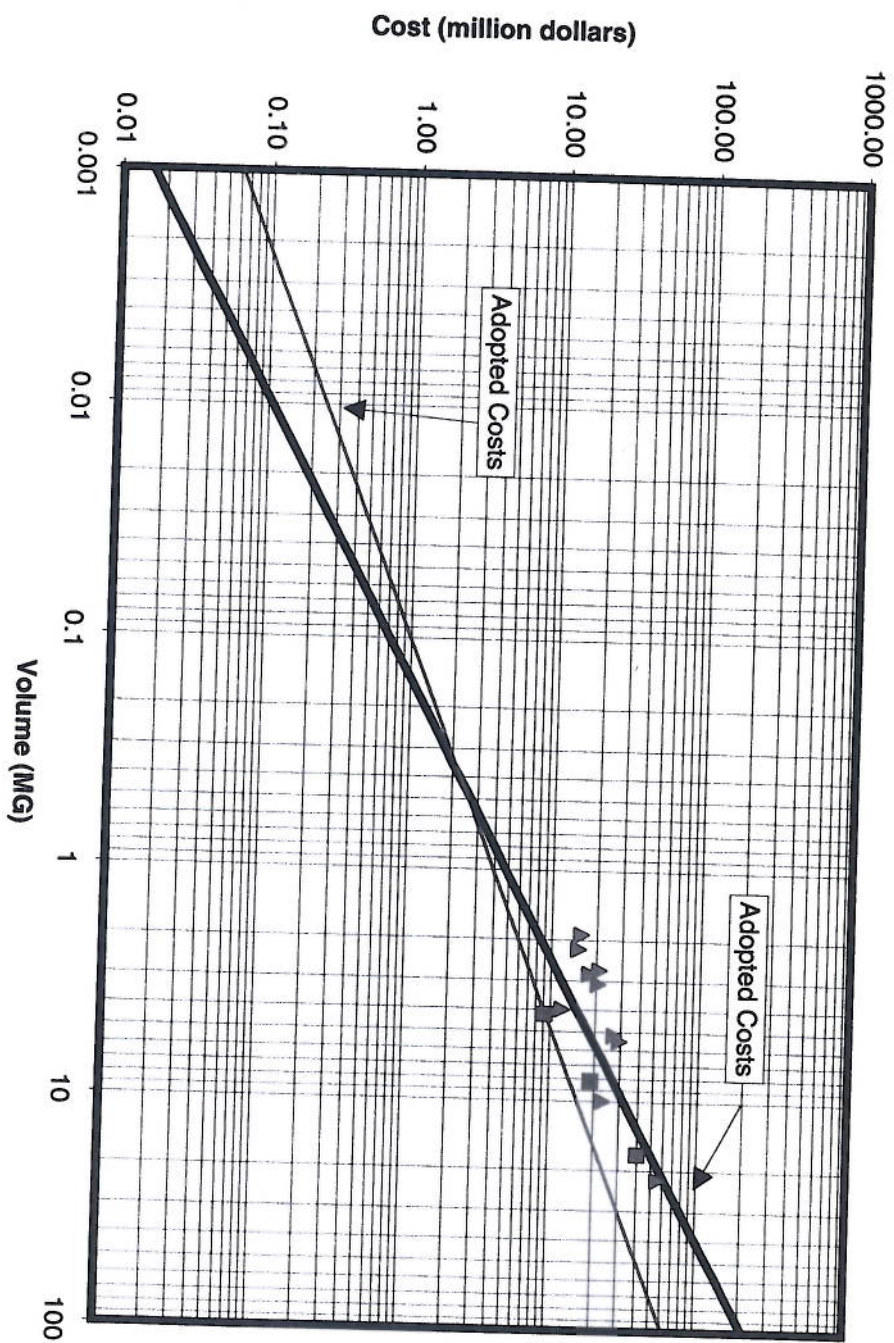


**Figure 4**  
**Updated Comparison of Disinfection Costs**

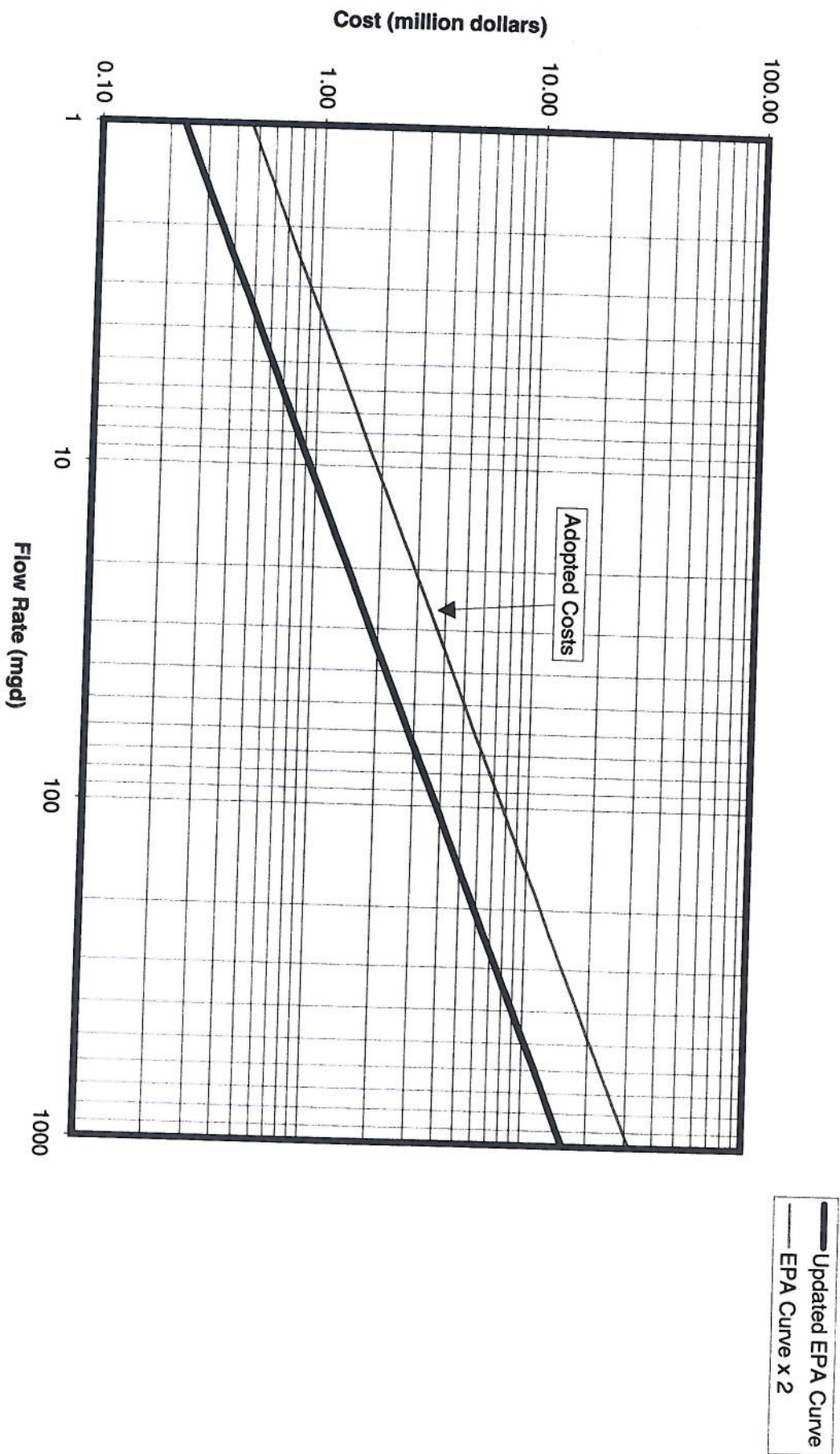




**Figure 5**  
**Comparison of Storage Costs**

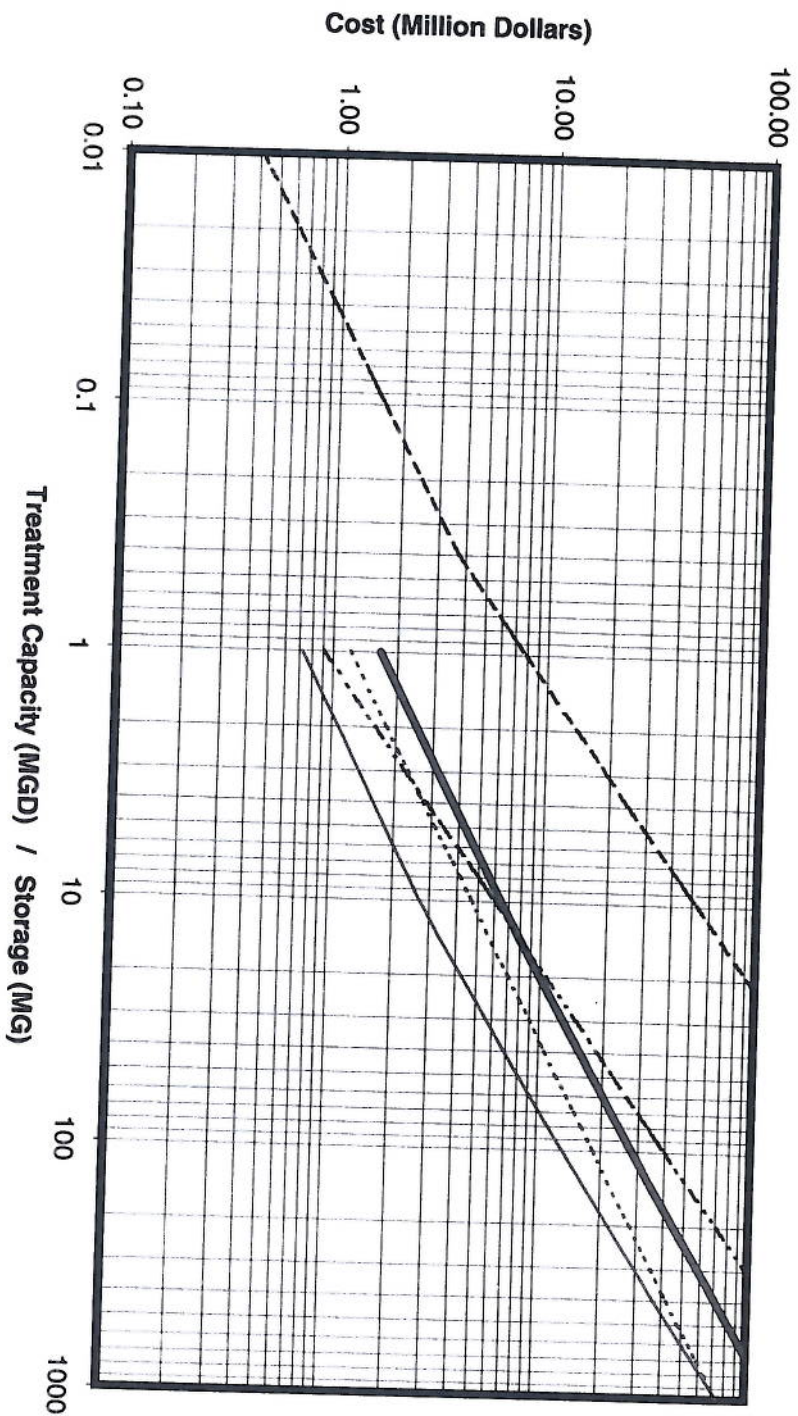


**Figure 6**  
**Comparison of Swirl Concentrator Costs**





**Figure 7**  
**Lowell, MA**  
**Capital Costs for CSO Control Facilities\***

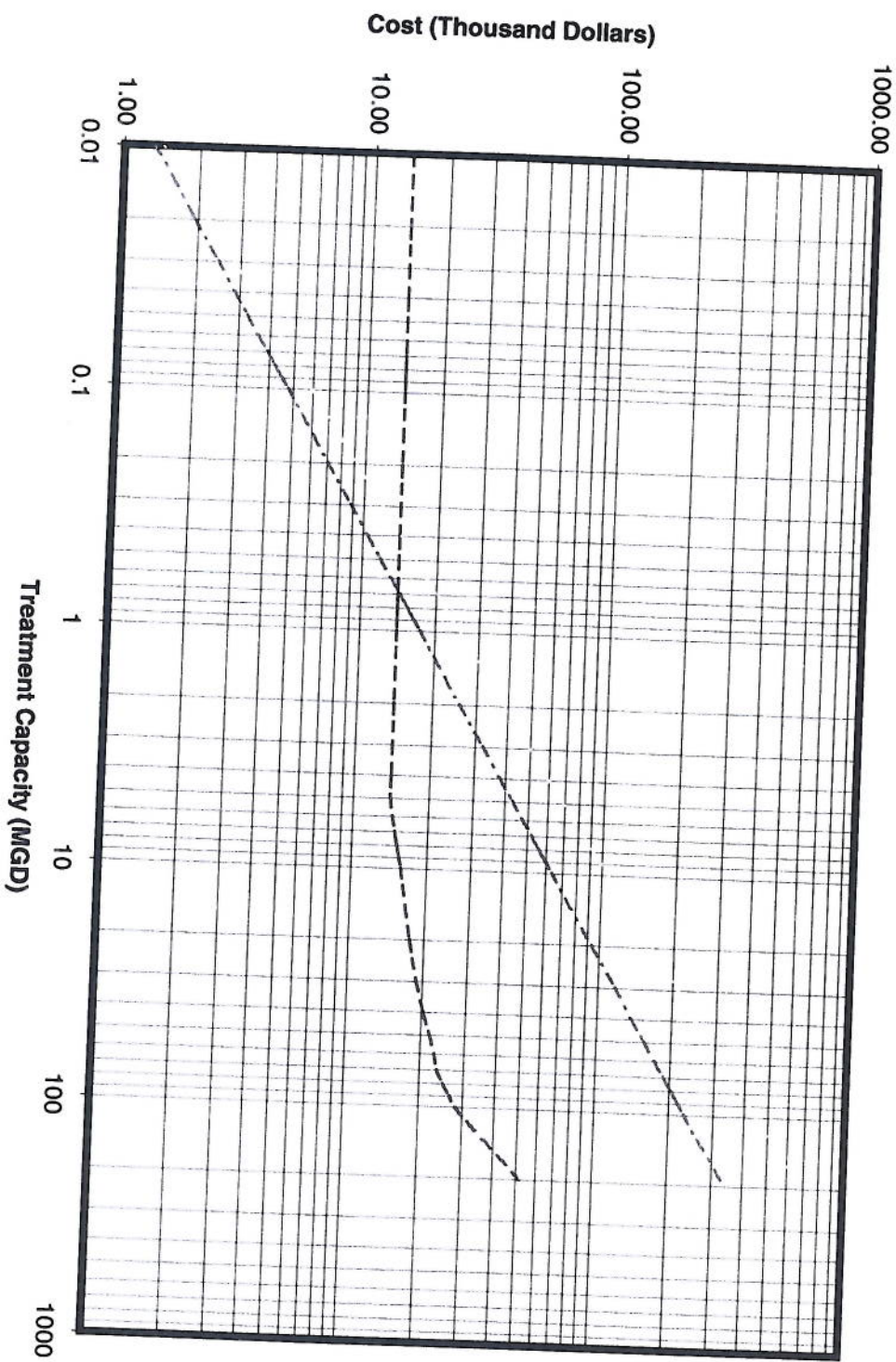


- Storage
- .... Swirl / Disinfection
- \_\_\_\_\_ Screen / Disinfection
- \_\_\_\_\_ Primary Treatment\*\*
- Pumping

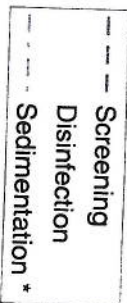
\*includes allowances for engineering and contingencies

\*\* includes screening, sedimentation, and disinfection

**Figure 8**  
**O & M Costs**

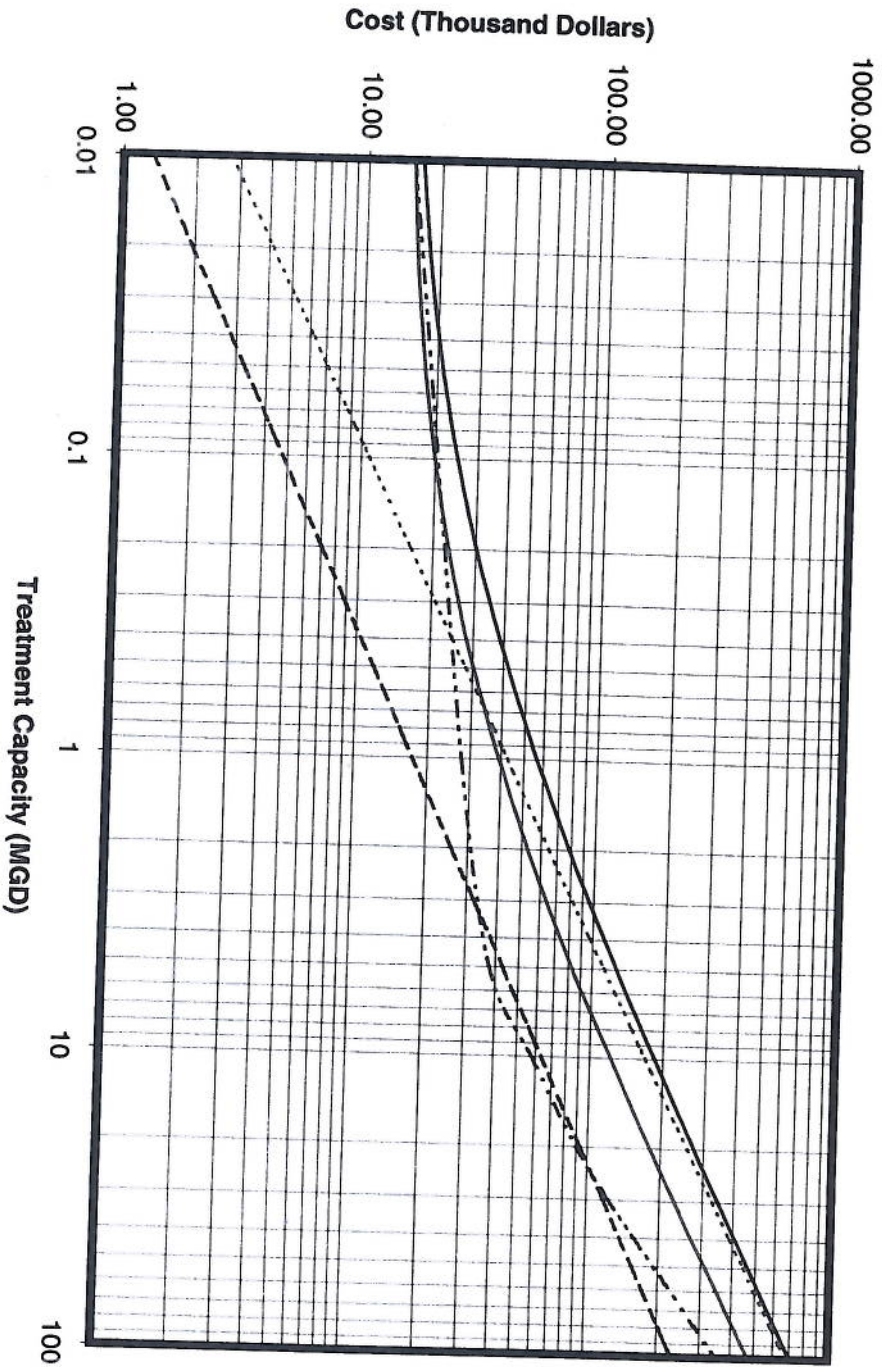


\* Sedimentation costs are assumed to be equal to O/M costs for both storage and swirl concentrator facilities





**Figure 9**  
**O & M Costs**



- Storage
- .... Swirl / Disinfection
- . - . Pumping
- \_\_\_\_\_ Screening / Disinfection
- \_\_\_\_\_ Primary Treatment \*

\* Primary Treatment  
includes screening,  
sedimentation, and  
disinfection

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Appendix  
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# WALKER STREET CSO FACILITY

TREATMENT	1-Month	3-Month	6-Month	1-Year	2-Year	5-Year
<u>Screening and Disinfection</u>						
Design Treatment Rate (mgd)	0.00	0.00	0.00	12.00	21.00	21.00
Capital Cost (million)	\$0.0	\$0.0	\$0.0	\$9.2	\$14.4	\$14.4
Annual O/M Costs	\$0.00	\$0.00	\$0.00	\$126,397	\$176,231	\$176,511
<b>Project Cost (million dollars)</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$10.0</b>	<b>\$15.3</b>	<b>\$15.3</b>
<u>Swirl Concentrators and Disinfection</u>						
Design Treatment Rate (mgd)	0.00	0.00	0.00	12.00	21.00	21.00
Capital Cost (million)	\$0.0	\$0.0	\$0.0	\$11.6	\$17.4	\$17.4
Annual O/M Costs	\$0.00	\$0.00	\$0.00	\$126,991	\$179,978	\$179,978
<b>Project Cost (million dollars)</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$12.3</b>	<b>\$18.3</b>	<b>\$18.3</b>
<u>Primary Treatment (Screening, sedimentation, disinfection)</u>						
Design Treatment Rate (mgd)	0.00	0.00	0.00	12.00	21.00	21.00
Capital Cost (million)	\$0.0	\$0.0	\$0.0	\$13.7	\$20.3	\$20.3
Annual O/M Costs	\$0.00	\$0.00	\$0.00	\$196,243	\$271,838	\$272,117
<b>Project Cost (million dollars)</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$15.0</b>	<b>\$21.9</b>	<b>\$21.9</b>
<u>STORAGE</u>						
Design Volume (MG)	0.00	0.00	0.00	0.50	0.80	2.60
Capital Cost (million)	\$0.0	\$0.0	\$0.0	\$4.0	\$5.9	\$15.5
Annual O/M Costs	\$0.00	\$0.00	\$0.00	\$69,846	\$95,606	\$95,606
<b>Project Cost (million dollars)</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$4.5</b>	<b>\$6.5</b>	<b>\$15.5</b>
<b>TOTAL SEPARATION (adjusted for 20-year life cycle costs) - \$8,056,136</b>						

## NOTE:

Capital Costs for facilities include 50 percent engineering and contingencies. No land acquisition costs are included.  
 Capital Costs for pipelines include 45 percent engineering and contingencies. No land acquisition costs are included.  
 Project Cost equals life cycle cost of capital expenditures and 20-year present value of annual O/M costs.

# WEST STREET CSO FACILITY

TREATMENT	1-Month	3-Month	6-Month	1-Year	2-Year	5-Year
<b>Screening and Disinfection</b>						
Design Treatment Rate (mgd)	0.00	0.00	145.00	141.00	191.00	231.00
Capital Cost (million)	\$0.0	\$0.0	\$66.5	\$65.0	\$82.7	\$96.2
Annual O/M Costs	\$0.00	\$0.00	\$568,518	\$559,503	\$674,815	\$759,084
<b>Project Cost (million dollars)</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$66.2</b>	<b>\$66.8</b>	<b>\$84.6</b>	<b>\$98.1</b>
<b>Swirl Concentrators and Disinfection</b>						
Design Treatment Rate (mgd)	0.00	0.00	145.00	141.00	191.00	231.00
Capital Cost (million)	\$0.0	\$0.0	\$72.5	\$71.0	\$89.1	\$102.8
Annual O/M Costs	\$0.00	\$0.00	\$599,981	\$589,613	\$712,376	\$801,991
<b>Project Cost (million dollars)</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$74.2</b>	<b>\$72.7</b>	<b>\$91.0</b>	<b>\$104.7</b>
<b>Primary Treatment (Screening, sedimentation, disinfection)</b>						
Design Treatment Rate (mgd)	0.00	0.00	145.00	141.00	191.00	231.00
Capital Cost (million)	\$0.0	\$0.0	\$85.4	\$83.6	\$105.1	\$121.4
Annual O/M Costs	\$0	\$0	\$851,168	\$837,752	\$1,004,714	\$1,126,119
<b>Project Cost (million dollars)</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$89.0</b>	<b>\$87.2</b>	<b>\$109.1</b>	<b>\$125.6</b>
<b>STORAGE</b>						
Design Volume (MG)	0.00	0.00	2.70	7.70	16.40	58.20
Capital Cost (million)	\$0.0	\$0.0	\$16.0	\$38.0	\$70.9	\$201.5
Annual O/M Costs	\$0.00	\$0.00	\$282,650	\$278,249	\$329,899	\$367,035
<b>Project Cost (million dollars)</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$18.0</b>	<b>\$38.5</b>	<b>\$69.7</b>	<b>\$192.1</b>
<b>TOTAL SEPARATION (adjusted for 20-year life cycle costs) - \$33,061,144</b>						

## NOTE:

Capital Costs for facilities include 50 percent engineering and contingencies. No land acquisition costs are included.  
 Capital Costs for pipelines include 45 percent engineering and contingencies. No land acquisition costs are included.  
 Project Cost equals life cycle cost of capital expenditures and 20-year present value of annual O/M costs.



# READ STREET CSO FACILITY

TREATMENT	1-Month	3-Month	6-Month	1-Year	2-Year	5-Year
<b>Screening and Disinfection</b>	Design Treatment Rate (mgd)					
	Capital Cost (million)	1.00	10.00	27.00	65.00	100.00
	Annual O/M Costs	\$1.5	\$8.0	\$17.5	\$35.2	\$49.5
<b>Swirl Concentrators and Disinfection</b>	Design Treatment Rate (mgd)					
	Capital Cost (million)	\$32,278	\$112,948	\$203,799	\$348,380	\$453,602
	Annual O/M Costs	\$1.8	\$8.7	\$18.6	\$36.6	\$51.1
<b>Primary Treatment (Screening, sedimentation, disinfection)</b>	Design Treatment Rate (mgd)					
	Capital Cost (million)	1.00	10.00	27.00	65.00	100.00
	Annual O/M Costs	\$2.0	\$10.2	\$20.9	\$39.9	\$54.9
<b>STORAGE</b>	Design Volume (MG)					
	Capital Cost (million)	\$26,996	\$107,666	\$210,490	\$363,911	\$475,970
	Annual O/M Costs	\$2.2	\$10.7	\$21.9	\$41.2	\$56.5
<b>TOTAL SEPARATION (adjusted for 20-year life cycle costs) -</b>	Design Treatment Rate (mgd)					
	Capital Cost (million)	1.00	10.00	27.00	65.00	100.00
	Annual O/M Costs	\$2.6	\$12.1	\$24.2	\$46.8	\$64.6
<b>NOTE:</b>	Design Volume (MG)					
	Capital Cost (million)	\$49,605	\$176,003	\$313,881	\$528,585	\$683,070
	Annual O/M Costs	\$2.9	\$13.2	\$26.0	\$49.4	\$67.8
<b>Planned Improvements and Maximum In-Line Storage</b>	Design Volume (MG)					
	Capital Cost (million)	0.01	0.30	1.00	3.30	8.70
	Annual O/M Costs	\$0.4	\$2.9	\$7.1	\$18.9	\$42.0
<b>Facility Project Costs</b>	Design Volume (MG)					
	Capital Cost (million)	\$17,327	\$63,055	\$110,082	\$180,205	\$229,468
	Annual O/M Costs	\$0.6	\$3.4	\$7.8	\$19.6	\$41.7
<b>TOTAL SEPARATION (adjusted for 20-year life cycle costs) - \$11,619,427</b>						

**NOTE:** Capital Costs for facilities include 50 percent engineering and contingencies. No land acquisition costs are included.  
 Capital Costs for pipelines include 45 percent engineering and contingencies. No land acquisition costs are included.  
 Project Cost equals life cycle cost of capital expenditures and 20-year present value of annual O/M costs.

# TILDEN STREET CSO FACILITY

TREATMENT	1-Month	3-Month	6-Month	1-Year	2-Year	5-Year
<u>Screening and Disinfection</u>	Design Treatment Rate (mgd)			33.00	38.00	38.00
	Capital Cost (million)	0.00	26.00	\$20.5	\$23.0	\$23.0
	Annual O/M Costs	\$0.0	\$199,221	\$230,733	\$251,525	\$251,805
	<b>Project Cost (million dollars)</b>	<b>\$0.0</b>	<b>\$18.1</b>	<b>\$21.7</b>	<b>\$24.2</b>	<b>\$24.2</b>
<u>Swirl Concentrators and Disinfection</u>	Design Treatment Rate (mgd)	0.00	26.00	33.00	38.00	38.00
	Capital Cost (million)	\$0.0	\$20.4	\$24.3	\$26.9	\$26.9
	Annual O/M Costs	\$0	\$205,598	\$238,528	\$260,447	\$260,447
	<b>Project Cost (million dollars)</b>	<b>\$0.0</b>	<b>\$21.3</b>	<b>\$25.2</b>	<b>\$27.9</b>	<b>\$27.9</b>
<u>Primary Treatment (Screening, sedimentation, disinfection)</u>	Design Treatment Rate (mgd)	0.00	26.00	33.00	38.00	38.00
	Capital Cost (million)	\$0.0	\$23.6	\$27.9	\$30.8	\$30.8
	Annual O/M Costs	\$0	\$306,997	\$353,932	\$384,871	\$385,151
	<b>Project Cost (million dollars)</b>	<b>\$0.0</b>	<b>\$25.4</b>	<b>\$29.9</b>	<b>\$33.0</b>	<b>\$33.0</b>
STORAGE	Design Volume (MG)	0.00	0.60	2.40	3.20	13.70
	Capital Cost (million)	\$0.0	\$4.6	\$14.5	\$18.4	\$61.1
	Annual O/M Costs	\$0	\$107,776	\$123,199	\$133,346	\$133,346
	<b>Project Cost (million dollars)</b>	<b>\$0.0</b>	<b>\$5.5</b>	<b>\$14.9</b>	<b>\$18.6</b>	<b>\$58.5</b>
<b>TOTAL SEPARATION (adjusted for 20-year life cycle costs) - \$19,910,166</b>						

## NOTE:

Capital Costs for facilities include 50 percent engineering and contingencies. No land acquisition costs are included.  
 Capital Costs for pipelines include 45 percent engineering and contingencies. No land acquisition costs are included.  
 Project Cost equals life cycle cost of capital expenditures and 20-year present value of annual O/M costs.



# WARREN "C" CSO FACILITY

TREATMENT	1-Month	3-Month	6-Month	1-Year	2-Year	5-Year
<b>Screening and Disinfection</b>						
Design Treatment Rate (mgd)	10.00	39.00	77.00	96.00	104.00	112.00
Capital Cost (million)	\$8.0	\$23.4	\$40.2	\$47.9	\$51.0	\$54.1
Annual O/M Costs	\$112,528	\$254,385	\$385,345	\$441,845	\$464,353	\$486,226
<b>Project Cost (million dollars)</b>	<b>\$8.7</b>	<b>\$24.7</b>	<b>\$41.7</b>	<b>\$49.5</b>	<b>\$52.7</b>	<b>\$55.8</b>
<b>Swirl Concentrators and Disinfection</b>						
Design Treatment Rate (mgd)	10.00	39.00	77.00	96.00	104.00	112.00
Capital Cost (million)	\$10.2	\$27.4	\$45.3	\$53.3	\$56.6	\$59.8
Annual O/M Costs	\$113,353	\$254,930	\$404,432	\$464,015	\$487,746	\$510,799
<b>Project Cost (million dollars)</b>	<b>\$10.8</b>	<b>\$28.4</b>	<b>\$46.7</b>	<b>\$54.8</b>	<b>\$58.1</b>	<b>\$61.4</b>
<b>Primary Treatment (Screening, sedimentation, disinfection)</b>						
Design Treatment Rate (mgd)	10.00	39.00	77.00	96.00	104.00	112.00
Capital Cost (million)	\$12.1	\$31.4	\$53.1	\$62.7	\$66.5	\$70.3
Annual O/M Costs	\$182,850	\$389,689	\$583,517	\$666,118	\$698,926	\$730,757
<b>Project Cost (million dollars)</b>	<b>\$13.3</b>	<b>\$33.6</b>	<b>\$55.9</b>	<b>\$65.8</b>	<b>\$69.7</b>	<b>\$73.6</b>
<b>STORAGE</b>						
Design Volume (MG)	0.30	1.90	5.20	8.80	12.00	32.20
Capital Cost (million)	\$2.9	\$12.0	\$27.5	\$42.4	\$54.8	\$123.6
Annual O/M Costs	\$63,055	\$135,303	\$198,172	\$224,272	\$234,573	\$244,530
<b>Project Cost (million dollars)</b>	<b>\$3.4</b>	<b>\$12.7</b>	<b>\$27.8</b>	<b>\$42.0</b>	<b>\$53.7</b>	<b>\$118.1</b>
<b>TOTAL SEPARATION (adjusted for 20-year life cycle costs) -</b>	<b>\$25,549,461</b>					

## NOTE:

Capital Costs for facilities include 50 percent engineering and contingencies. No land acquisition costs are included.  
 Capital Costs for pipelines include 45 percent engineering and contingencies. No land acquisition costs are included.  
 Project Cost equals life cycle cost of capital expenditures and 20-year present value of annual O/M costs.  
 Warren "C" - Consists of 25.4% of the total flow to the Warren Street CSO Structure.

# BARASFORD AVENUE CSO FACILITY

TREATMENT	1-Month	3-Month	6-Month	1-Year	2-Year	5-Year
<b>Screening and Disinfection</b>						
Design Treatment Rate (mgd)	0.00	0.00	48.00	75.00	75.00	75.00
Capital Cost (million)	\$0.0	\$0.0	\$7.9	\$10.9	\$10.9	\$10.9
Annual O/M Costs	\$0	\$0	\$288,749	\$379,883	\$380,163	\$380,442
<b>Project Cost (million dollars)</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$10.5</b>	<b>\$14.4</b>	<b>\$14.4</b>	<b>\$14.4</b>
<b>Swirl Concentrators and Disinfection</b>						
Design Treatment Rate (mgd)	0.00	0.00	48.00	75.00	75.00	75.00
Capital Cost (million)	\$0.0	\$0.0	\$12.2	\$15.9	\$15.9	\$15.9
Annual O/M Costs	\$0	\$0	\$301,261	\$397,853	\$397,853	\$397,853
<b>Project Cost (million dollars)</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$14.7</b>	<b>\$19.2</b>	<b>\$19.2</b>	<b>\$19.2</b>
<b>Primary Treatment (Screening, sedimentation, disinfection)</b>						
Design Treatment Rate (mgd)	0.00	0.00	48.00	75.00	75.00	75.00
Capital Cost (million)	\$0.0	\$0.0	\$17.6	\$23.6	\$23.6	\$23.6
Annual O/M Costs	\$0	\$0	\$440,768	\$575,151	\$575,431	\$575,710
<b>Project Cost (million dollars)</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$21.2</b>	<b>\$28.3</b>	<b>\$28.3</b>	<b>\$28.3</b>
<b>STORAGE</b>						
Design Volume (MG)	0.00	0.00	2.60	6.30	9.30	26.20
Capital Cost (million)	\$0.0	\$0.0	\$15.5	\$32.2	\$44.4	\$104.3
Annual O/M Costs	\$0	\$0	\$152,019	\$195,268	\$195,268	\$195,268
<b>Project Cost (million dollars)</b>	<b>\$0.0</b>	<b>\$0.0</b>	<b>\$16.1</b>	<b>\$32.2</b>	<b>\$43.6</b>	<b>\$99.5</b>
<b>TOTAL SEPARATION (adjusted for 20-year life cycle costs) - \$42,117,658</b>						

## NOTE:

Capital Costs for facilities include 50 percent engineering and contingencies. No land acquisition costs are included.  
 Capital Costs for pipelines include 45 percent engineering and contingencies. No land acquisition costs are included.  
 Project Cost equals life cycle cost of capital expenditures and 20-year present value of annual OM costs.



# MERRIMACK RIVER CSO FACILITY

TREATMENT	1-Month	3-Month	6-Month	1-Year	2-Year	5-Year
<u>Screening and Disinfection</u>	Design Treatment Rate (mgd)					
	Capital Cost (million)	39.00		154.00	166.00	159.00
	Annual O/M Costs	\$23.4		\$69.7	\$74.0	\$71.5
	<u>Project Cost (million dollars)</u>	\$254,106		\$590,714	\$618,934	\$603,011
		\$24.7		\$71.5	\$75.8	\$73.3
<u>Swirl Concentrators and Disinfection</u>	Design Treatment Rate (mgd)					
	Capital Cost (million)	39.00	98.00	154.00	166.00	159.00
	Annual O/M Costs	\$27.4	\$48.7	\$75.8	\$80.2	\$77.7
	<u>Project Cost (million dollars)</u>	\$264,697	\$446,627	\$622,924	\$652,744	\$635,452
		\$28.5	\$50.3	\$77.6	\$82.0	\$79.4
<u>Primary Treatment (Screening, sedimentation, disinfection)</u>	Design Treatment Rate (mgd)					
	Capital Cost (million)	39.00	98.00	154.00	166.00	159.00
	Annual O/M Costs	\$31.4	\$63.6	\$89.4	\$94.6	\$91.6
	<u>Project Cost (million dollars)</u>	\$396,675	\$673,509	\$883,075	\$923,866	\$900,660
		\$33.6	\$66.8	\$93.1	\$98.4	\$95.3
<u>STORAGE</u>	Design Volume (MG)	1.60	8.70	19.80	24.60	48.80
	Capital Cost (million)	\$10.4	\$42.0	\$82.8	\$99.0	\$174.2
	Annual O/M Costs	\$135,303	\$226,882	\$292,362	\$304,932	\$297,650
	<u>Project Cost (million dollars)</u>	\$11.2	\$41.7	\$80.5	\$95.8	\$165.9
<b>TOTAL SEPARATION (adjusted for 20-year life cycle costs) - \$24,132,998</b>						

## NOTE:

Capital Costs for facilities include 50 percent engineering and contingencies. No land acquisition costs are included.  
 Capital Costs for pipelines include 45 percent engineering and contingencies. No land acquisition costs are included.  
 Project Cost equals life cycle cost of capital expenditures and 20-year present value of annual O/M costs.